MEDIATING EQUITY IN SHARED WATER BETWEEN COMMUNITY AND INDUSTRY: THE EFFECTS OF AN AFTER SCHOOL PROGRAM THAT ADDRESSES ADOLESCENTS' KNOWLEDGE, ATTITUDES, AND PERCEPTIONS OF WATER SCIENCE AND ENVIRONMENTAL ISSUES

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Chapter 1: Introduction

After two years in Teach for America, I was supposed to go back to school. That was our plan, my father reminded me. But I wasn't ready; I still wanted to live abroad. My desire to live outside the United States grew after six months of studying abroad in Buenos Aires. I still wanted to travel and speak perfect Spanish before specializing in graduate school or "settling down." On a weekend in January, I flew to rural Iowa for one of the best-established international teaching job fairs in the world. I was on a plane from McAllen, Texas, on Thursday morning, in an interview in Cedar Rapids, Iowa, on Friday afternoon, and signing a contract to live in Barranquilla, Colombia, by Saturday morning.

When I called home to report the news, my parents were far from pleased. Not only was I not going back to school, but I was also moving to a developing[1] country with a history of armed conflict[2]. In the process of making a compromise, I applied to a Master of Education program at Texas Christian University (TCU), was accepted, and enrolled in summer classes. The compromise was this: I would come home in the summers and take classes that could contribute to a graduate degree.

During the summer of 2009, my advisor and I decided that in the fall semester we would experiment with a personalized distance-learning program to allow me to live in Colombia but attend graduate classes in Fort Worth. Each week I would Skype into class to listen to lectures, contribute to discussions, give presentations, and take exams. Because the first semester went so well, my advisor allowed me to continue my degree program from a distance. Now, two years later, I am writing a final thesis. Because my innovative degree program used technology to personalize my education experience, I was able to complete an intellectually rigorous degree

from a respected university while living in Colombia, a developing country where access to water and sanitation are serious issues. This thesis is a reflection of the limitlessness of my individualized program of study.

The following critical ethnography deconstructs how I came to understand young adults' changing knowledge about water science and environmental issues in an after school program in Colombia. In March 2010, I began assisting Becky Anderson in teaching an after school program in the neighborhood of Mesolandia in the Malambo municipality. This is a costal community situated near the city of Barranquilla, in the Colombian state of Atlántico. In September 2010, I took over instruction for the after school program and began concurrently to develop and teach an environmental and social justice curriculum. After I received Internal Review Board (IRB) approval, I began collecting data for this ethnography.

In this study, I am both the primary teacher of the after school program and the lead researcher. In the final chapter of this work, I discuss the challenges and benefits of being in each of these roles. However, in order to be as trustworthy and transparent as possible, I must first assert that it would be unrealistic to intellectually separate the two roles I played in the research. Nonetheless, in my analysis of the data, I attempted to be as unbiased as possible. There were times during this project when I made bad choices in teaching execution that negatively influenced student learning. There were also days I felt victorious as a teacher when students made progress. In field notes, journals, and interviews I alternated fluidly between these two roles. In my analysis, I try to distill the data to fairly represent how my actions as a teacher affected student learning. The study took place over an eight-month period. During this time, the after school program had twenty-one meetings. All our meetings took place in

Mesolandia except two for two field trips to Parrish, the school where I work, for a computer day and a Values Forum presentation.

In the following chapters, I document the results of student participation in an after school program that intended to empower self-identified young community leaders by teaching participants to engage community[3] members in discourse related to how environmental factors impact one's level of health and quality of life. I hope to illustrate how student participants responded to particular curricular components used to teach the after school program, assess their interest in and knowledge of local water ecology and sanitation infrastructure, and analyzes their responses to the use of technology and digital media in a curriculum that utilized hands-on science teaching and social justice coaching.

Mesolandia: You've never seen poverty like this

I first heard about Mesolandia from three Colombian teachers, with whom I work, when they were attending an Advanced Placement workshop in Fort Worth. This was only weeks before my departure to Colombia, and all I knew of the country was what I had heard from family and friends and read on the Internet. The teachers told me that Becky, one of the other American teachers who had previously been in the Peace Corps, would travel weekly to a dangerous part of the city to work with underprivileged children. I met Becky a few weeks later during my school orientation and asked her if I could go with her when she did her community service. I did not make it to Mesolandia until four months later when Becky's students did a fundraiser Bingo in the last week of November 2009. That Saturday afternoon was my introduction to this community and my first exposure to true urban poverty in a developing country.

Becky did her best to prepare me for what I was about to witness. The biggest lesson she learned during her time in the Peace Corps was that being part of positive changes in a community was far more likely in a place with access to some basic resources. In the Dominican Republic, for example, she worked in a community where people had access to cell phones, latrines, medical care, and education. In Mesolandia, she warned me, the poverty was so severe that it felt like progress with the after school program participants was tediously slow and she never felt confident that she was making a difference. Becky taught a curriculum that focused on pregnancy and sexually transmitted disease prevention. Every week, for two years, Becky traveled the hour to Mesolandia to work with the youth group. It was clear to me, as a visitor, that the students cared about the group activities and had a tremendous amount of respect for Becky. Nonetheless, by the time she left Colombia, three of the young women who had participated in the group activities were pregnant.

When I arrived in Mesolandia for the first time, I indeed witnessed heart-breaking poverty. I saw the dirt roads, the dirty malnourished children, and the pathetic stray dogs. What I remember most profoundly was a white brick house with an open doorway only as tall as my chest.

Figure 1: Sinking doorway in Mesolandia

I do not remember if I saw furniture or people inside the house, but I remember Becky pointing to the doorway and telling me that you could guess the socioeconomic status of a family simply by looking at the height of the doorway. Because the community is on the muddy banks of the Magdalena River, the cement bricks that people use to build shelter constantly sink into the mud. Families must build their houses up each year or end up with a doorway like the one I was seeing.

As we walked down the hill from the paved highway toward the river, two of Mesolandia's geographic borders, Valentina[4] walked up the hill to meet us. She was wearing the bright red polo with the group's logo "*Clase Aparte*" embroidered on the chest. She had earned the shirt by giving three presentations to community members about a topic the group had studied. She told us that several of the group members' moms were frying *papas rellenas*, her father was preparing the music for the bingo, and her mother was helping to wrap the gifts they had gathered. The excitement the bingo was generating in the community was palpable. After hours of gift-wrapping and other preparations, we began the bingo. We had been in Mesolandia for hours and I was sweating profusely. The back of my t-shirt was soaked and my bladder was full of the water I had been drinking to try to stay hydrated in the midday Barranquilla heat. I am a seasoned camper, but no amount of outdoor bathroom use could have prepared me for going to the bathroom in the back yard of one of Becky's students. A wall-like structure, situated in front of a shallow hole that ran into a hand-dug shallow ditch-there are no bathrooms, no outhouses, no latrines in Mesolandia—only shallow ditches that make their way from one puddle of water to the next until rain or gravity washes the raw sewage into the river.

This experience stuck with me and guided me to a new plan of study. I enrolled in an Environmental Science class that addressed issues of access to clean water and sanitation. Seeing a need for improved sanitation and lessons learned in my graduate studies helped me understand a social justice connection between the health of one's immediate environment and one's quality of life. How can we ask mothers, fathers, and children to attend to prenatal care, contraception, politics, literacy, or anything else when they are living with so many basic challenges? I began to ask myself what the industries around the community, the government, the local municipality and the community itself could do to address these basic needs: access to clean drinking water, protection from industrial pollution of the air and water, and domestic sanitation systems.

Finally, lessons from the Water and Wastewater Technologies course, combined with my first experiences in Mesolandia, drove me to design an after-school program curriculum. I began to develop ideas for learning goals that could help students connect ecology, public health, and social inequality. I hoped that by increasing their knowledge base, they might develop into community leaders with the knowledge and skills to increase access to clean drinking water, reduce industrial pollution near the community, and obtain municipal trash and sanitation services.

Water and Sanitation in Colombia and Around the World

In 2000, the United Nations (2010) released The Millennium Declaration that outlined global development goals agreed upon by 189 world leaders. The goals include a target to "ensure environmental sustainability" by halving "the proportion of the population without sustainable access to safe drinking water and basic sanitation" (p. 58). According to a United

Nations (2010) report a decade after the Millennium goals were proposed, the percentage of people with access to drinking water in urban areas has remained unchanged, drinking water quality in urban areas has diminished due to agriculture and manufacturing, and 48 percent of people living in the world's developing regions live without basic sanitation. Urban areas in Colombia are microsystems that exemplify these global water and sanitation issues.

Colombia is one of the most water-rich countries in the world. It is one of just six nations that have, within their borders, half of the world's total renewable freshwater supply (Pearce, 2007). However, rivers in Colombia are severely polluted, seven percent of the population live without adequate access to clean drinking water (Gleick, 2009), and 17 percent of urban populations lack improved sanitation[5] facilities (Joint Monitoring Programme for Water Supply and Sanitation, 2010). Like in many developing nations, a large percentage of the population is migrating (or being displaced) to urban areas where the municipal infrastructure is not keeping up with population growth. According to Segerfeldt (2005), 48% of the world's population currently lives in urban areas. He projects that this population will rise to 60% by 2030. Rapid and chaotic urbanization in Colombia is occurring at a higher rate due to the anti-insurgency and anti-narcotics campaigns sustained over the last seven years under President Alfredo Uribe (Internal Displacement Monitoring Centre [IDMC], 2009). Although these efforts have clearly weakened the Revolutionary Armed Forces of Colombia (FARC) and reduced kidnapping and homicide rates, they have also disrupted unofficial governance of rural areas by illegal armed groups and, by default, made cities safer places to live for people who were forced to give up their land. According to IDMC (2009), most displaced people in Colombia cite direct threats as the main reason they elect to leave their rural homes. IDMC (2009) explains, "threats are used to intimidate the civilian population and maintain the domination of illegal groups over certain

areas, and also as a tool to drive small farmers from land to develop legal and illegal crops" (p. 3). Internal displacement currently affects 4.6 million people in Colombia, between six and ten percent of the population, making it second in the world for the most internally displaced people after Sudan (IDMC, 2009). Of this population, 94 percent live below the poverty line and 94.5 percent live in shelters that do not allow them access to safe drinking water or sanitation (IDMC, 2009). The IDMC has identified the region surrounding Barranquilla as one of the areas of the country most in need of addressing the basic rights of this population, including access to shelter, clean drinking water, and sanitation.

Water infrastructure development in urban areas has become increasingly important in the international water debate and in the discourse surrounding social equity, public health, and human rights. Colombia is unique in that it has access to huge quantities of water but struggles to control the contamination of its rivers, industrial pollution, and domestic sanitation. However, according to Resources for the Future (RFF) (2010), Colombia is one of the most environmentally progressive countries in Latin America. The RFF reports, "it was one of the first countries in the region to organize environmental administration along watershed boundaries, pilot a system of pollution taxes, require environmental impact assessments for large construction projects, and institutionalize legal remedies against polluters" (para. 1). Because of these programs, pollution in major Colombian rivers after 1997 decreased significantly. Nonetheless, because of illegal industrial dumping and a lack of domestic sanitation infrastructure, the country still has significant environmental and human rights issues to address concerning water and sanitation.

The larger geopolitical and environmental history of Colombian water issues is significant to this study because of the delicate theoretical relationship that exists between the

public, industry, government and policy related to environmental matters, social equity, and public health. The significance of global water discourse was illustrated in a special edition of *National Geographic* in April 2010. In this publication, Kingsolver (2010) writes, "Water is life. It's the briny broth of our origin, the pounding circulatory system of the world. We stake out civilizations on the coasts and mighty rivers. Our deepest dread is the treat of having too little- or too much" (p. 38). In an article that provided a human face to a discussion about global water issues, Rosenberg (2010) writes about an African woman, Aylito Binayo's, life of too little water. She is one of the millions of women and girls worldwide who spend the majority of their day, and the majority of their lives, hauling water long distances. According to Rosenberg (2010), Binayo dropped out of school at the age of eight and has been hauling 50 pounds of water on her back, up a mountain, three times a day, for the last 17 years. While she hauls water eight hours per day, she is still responsible for tending to family crops, animals, and her three small sons. Women all over the world are severely impacted by lack of access to water and water shortages.

Sheryn, a Mesolandia resident and participant in this study, is in charge of water in her household. She recently dropped out of school, in part, to wait each day for unpredictable water service. Her grandmother's house, next door to her house, has water service for a few hours a day, if at all, (Sheryn's house has none) and she is in charge of filling the family's tank that must last until the next time there is water. The water company shut off service to Sheryn's house in December when her mother stopped paying the water bill. Sheryn explained that in December, poor piping caused an interruption in the water service for several days and when there was water at the tap, it came out yellow and malodorous. Inconsistent water service persisted for several months and is still unpredictable as of April 2011. Around the same time, Sheryn's

infant brother was involved in an accident with acid that burned the skin on his back. Although I do not know how his skin was burned, Sheryn and Maria Fernanda, another participant, explained how his burned skin, combined with a lack of access to water has affected Sheryn's livelihood. Sheryn explained, "[My brother] had the accident where he was burned and he is more sensitive now because the burn has to stay clean all the time." Maria Fernanda elaborated, "and when there is a lack of water he can get sick because she can't keep the floor clean. Sometimes [Sheryn] can't mop the floor because there is no water." Sheryn responded, "So, when he wants to get down [from my arms], because he crawls, I can't let him because the floor is not disinfected. This exhausts me because I spend the entire day carrying him while I am taking care of all the chores in my house. It is too much…" In this March interview with Sheryn and Maria Fernanda, explain how not having access water or improved sanitation played a role in Sheryn's decision to stay home each day instead of going to school. Instead, she studies only on Saturdays when her mother does not have to work.

Narratives like Aylito and Sheryn's are important illustrations of the definite connection between "poverty eradication, economic growth in developing countries and broader social development" (Pillay, 2006, p. 64). Women make up 70 percent of the world's population living in poverty and are often charged with the responsibility of collecting water (Tignino, 2007, p. 524). Researchers have linked access to clean water to all people, but especially women's, quality of life and ability to improve one's social position. Specifically, higher rates of education, better health, and lower risks of victimization in the form of rape and domestic violence are associated with women's access to clean drinking water and sanitation (Metwally, Saad, Ibrahim, Emam & El-Etreby, 2007; Conroy, Elmore-Meegan, Joyce, McGuigan, & Barnes, 1996; Holmstrom, 1999). Additionally, Pillay (2006) argues that no developing county

has been able to developmentally advance without "substantial investment in the human capital of its population" in the form of investments in education, health, nutrition, water, and sanitation (p. 4). Recently, discourse related to global water issues has surged, including topics related to international degradation of fresh water resources, sustainability of large scale water projects built in the last century, rapid global urbanization, and an immerging capital interest in water investments (Metwally, et al. 2007).

Three questions reappear in current literature on global the water issues and imply support for the purpose of this study. First, agriculture is using a copious amount of water to cultivate food for the growing world population. How do we grow enough food to feed people without destroying ecosystems and aquifers? Second, 884 million people do not have access to clean water, and an estimated 2.6 billion people lack access to improved sanitation facilities, while urban populations are increasing significantly all over the world (United Nations, 2010). How can infrastructure keep up with water and sanitation demands for this increasing, primarily impoverished, population? Lastly, water is the universal renewable resource, but if it is overly polluted, inaccessible, or unusable then it becomes a valuable resource and potentially a source of conflict. When regulating access and water-related conflicts, should authorities consider water a commodity to be bought and sold by private corporations for profit or is free access to water a human right?

The third debate about water ownership must be resolved first. Without a consensus on who owns water and who is responsible for providing water to the public, it is fruitless to debate other water related issues. Hoffmann (2009) argues this point well: If water is vital and, as such, a public good, then the implication is that governments must intervene to provide equitable

distribution. However, if it is truly a commodity, the implication is that market forces alone can readily provide optimal allocation. Hoffmann (2009) elaborates:

> Some economists argue simply that water must be defined as a social (public) good or a private good. It is precisely the language we use to describe water that determines how we address the numerous complex issues. (Ch. 3, para. 1,3)

Water issues are global and multifaceted, but local conflicts and debates depend on geography, governmentality, and the global market. Whether the local debate is about degradation or overuse of water, ultimately if there is no agreement about how communities and industries can share water, the discourse stalls.

Mesolandia is a community where displacement, migration, and institutional poverty have caused disorganized urbanization in a primarily industrial part of the city. It is geographically and sociopolitcially situated in the context of the global water debate because Mesolandia shares a border with Barranquilla, the fourth largest and most industrial city in Colombia. Mesolandia is a community bordered on one side by a highway and Barranquilla's International Airport, and by the Magdalena River on the opposite side. On the northern border of the community is a chicken processing plant and on the southern border an international shipping and cargo company.

In this community, some homes have running water but others do not. None of the homes are connected to a municipal sewer line. Sewage flows directly from the houses, through the dirt streets, and into the river. Every few years the river floods its banks during the rainy season and families live on makeshift lofts under the roof of their houses until the water recedes. Flooding of homes in the community causes public health and sanitation concerns. The year

(2010) has been especially wet and many families lived in flooded houses from June to December.

Sociopolitically, Mesolandia's position is also interesting. Colombia's government ranks socioeconomic status from zero to seven. Strata zero would be comparable to India's untouchable population while families in strata six and seven would be comparable to the wealthy, even in developed countries. The government classifies Mesolandia as a strata zero to two. Although the Malambo municipality serves Mesolandia, much of the aid received in this community comes from a non-profit organization called *Punto de Encuentro*. Even with aid, the desperate poverty and lack of basic services is quite evident from the moment one enters the community. For example, in January 2010, the school's roof collapsed and the administration canceled classes until the government rebuilt the school. By March 2010, when I began to work with the youth group, students had not regularly attended classes for several months. By June, it appeared that some classes had resumed, but only for three hour per day in a small building provided by a private charity.

After more than a year of construction, classes resumed in February 2011 in the new building. Ironically, the day after the school opened for classes, the principal cancelled school for the rest of the week because of problems with the school's water connection. As of April 2011, the school still had no water connection because the water company and local government had not come to an agreement about how the issue should be resolved. The dispute over the school's water connection demonstrates how questions about water ownership and public responsibility have not been universally resolved. Debates about resource ownership between local government and private industry are preventing disenfranchised students from obtaining an education in a safe and sanitary environment. Who owns the water, who must pay for it, and

who is responsible for ensuring children from Mesolandia have access to basic human rights like education, access to safe water, and improved sanitation? In the case of Mesolandia's school, both the local government and the private water company have failed to take responsibility to resolve the water connection problem.

I am interested in how students from Mesolandia came to understand the global water debate by learning more about local water issues. The literature on science, social justice and conservation education is far-reaching and diverse. However, recent works are disproportionally focused on the three questions discussed previously; water conservation, urban growth and sanitation, and water ownership. Due to an increase in discourse and attention related to the global water debate, many researchers are trying to determine what purpose education programs about water, sanitation, hygiene, and the environment serve in trying to address global water issues. This study contributes to that scholarship.

Chapter 2: Curriculum Development

The intention of the after school program was to associate water science and environmental education with issues of social justice and human rights, including public health and quality of life. Therefore, I taught the after school program lessons with three things in mind. First, I taught science lessons related to water and environmental science. Second, I used a critical feminist approach to help students identify what they perceived as the biggest environmental and health problems in their community. The critical feminist tradition of research takes a woman centered approach to explore links between knowledge and power and struggles against oppression (Schwandt, 2007, p111). Critical theory is empirical in nature and "holds that all knowledge is experiential" (p. 83). Finally, I asked students to combine what they learned about water, the environment, and the problems they identified into verbal and digital media presentations that they could used to share what they learned with members of their community, their peers in Mesolandia, and with a global online community.

As the teacher in this setting, I attempted to design weekly lessons that contained components that would address each of these learning goals. Examples of these activities included science labs and demonstrations, water testing, documentation of contamination with digital cameras, team building exercises, and the making and publishing of YouTube videos. The first lessons that took place in September 2010 diagnosed student knowledge of water sciences. The final goal of the year was for students to create a presentation they would share with their peers from all over the city at Parrish's annual *foro de valores* (values forum). In April 2009 and 2010 members of the after school program attended the values forum but had never created their own presentation. Additionally, group members were asked to plan two other

events in the community to share what they learned in the program. The first of these presentations took place in December 2010.

Science education in all parts of the world has inspired scholars to better understand how students learn science. As a result, many scholars seek to understand how to teach science in a way that inspires young people to pursue careers in natural and physical sciences. Angela Calabrese Barton, in particular, focuses extensively on how one teaches science education to underrepresented groups, both in the United States and internationally, through the perspective of a scientist, science teacher, feminist, critical theorist, and professor of education. She has dedicated sixteen years of scholarship to developing a new perspective on science education as a cultural practice the success of which depends on the appreciation of a student's understanding of the world based on environment, gender, socioeconomic status, ethnicity and nationality, among other factors. I used Barton's scholarship as a framework for my research and as a lens to develop my perspective.

Science Education as a Cultural Practice

Angela Calabrese Barton is a professor in teacher education at Michigan State University. In her professional career, she has focused on equity and social justice in urban science education. Barton (n.d.) identifies herself as a qualitative researcher who employs critical/feminist methodologies in ethnographies and case studies of urban communities, schools, and non-traditional learning environments. She (n.d.) has been on the forefront of literature related to teaching science for social justice, has developed methods for teaching social justice through science education, and has evaluated those methods. Barton (n.d) conducted research and has taught in roles similar to my position as teacher and researcher in Mesolandia.

Additionally, for the entirety of her career as an academic, Barton has written from a critical feminist perspective and has used critical ethnography as a methodology several times. Because of Barton's academic history, experiences, and conclusions about science education, I rely heavily on her findings to support how I developed my lessons to concurrently teach science and social justice.

In the last sixteen years, Barton has explored ways of teaching science that consider limitations hindering science learning in urban communities. Barton (1998b) identifies these limitations as inadequate resources, unqualified teachers, and lack of motivation and interest of students. In her earliest publications, Barton (1998b) seeks to understand "what it means to create science for all" (p.379). In her work with urban youth in an after school program at a homeless shelter, she concluded that as the teacher of the after school program, she had to teach science in a way that allowed for a diverse way of understanding the material (Barton, 1998b) and "needed to value a science which emerged from the intersections between the children's ways of knowing their world and ways of knowing and doing science" (p. 391-392). Barton's early work contributed to the understanding that tailoring science education to the needs and experience of the American white middle class ignores the needs of entire groups of science learners. Barton (1998b) argues that considering how children understand the world when designing science lessons, results in more engaged learning and more applicability to the world around them. She writes, "this kind of valuing of lived experience in science class complicates individual and collective representations of science and identities in science" (Barton, 1998b, p.392).

Barton's (1998a) work on feminist science education supports her conclusion that teachers must see science education as a cultural practice. She argues that helping students

understand science with examples from "real world experience" is an effective teaching method when these experiences are truly applicable to students' lives. She gives the following example:

> In physics classrooms, teachers (and children) talk about bicycle pumps, toasters, and electrical wiring systems in studying thermodynamics and electromagnetism. Questions that have been raised by feminist include, what happens when children do not have experiences with these kinds of things? (Barton, 1998a, p.91)

Barton's work with students in homeless shelters, much like my work with students in Mesolandia, brought her face to face with students who may have never pumped up a bike tire or even ridden a bike. Not having experienced what science teachers, textbooks and curriculums deem "real life examples," puts students like ours at a disadvantage. Barton (1998a) explains:

> As feminist researchers (Roychoudhury, Tippins, & Nichols, 1995; WISE, 1995) remind us, [science education] has historically favored the boys because of their experiences with machines, construction, and the world of work and men's bodies. Critical theorists (Apple, 1979, 1992, 1994; Giroux, 1985; Willis, 1977) remind us that schooling, moreover, favors children in families with financial and educational resources. (Barton, 1998a, p. 91)

Because Barton's scholarship focuses on students without financial and educational resources, she also has explored the reasons children in extreme poverty should learn science "beyond basic literacy skills" (Barton, 2002, p. 914). In a study conducted in Pakistan, Barton (2002) asks:

> What reasons are there to teach subject matter knowledge in schools,

> especially when most children will only leave these schools for menial labor positions – even if they were to acquire a strong academic background? The general opinion in Pakistan is that schooling is not of any use for those children who are destined to remain in the very poorest class for their lives. (p. 914)

In this study, Barton (2002), through the eyes of a Pakistani science teacher, argues that the "purpose" of learning science is not just to prepare or encourage children to pursue careers in science but to give children a chance "to be empowered enough to use science as a tool to make their lives and their communities the kinds of places they want to live" (p. 914). If one considers the ultimate goal of science education, one can further justify teaching science in conjunction with social justice as a way to empower students to think about the acquisition of science knowledge as an avenue for creating social change.

In addition to studying how to teach science, Barton (2006) documents experiences of students to demonstrate how "integrating student voice in a science project can make participation in science a valuable tool in students' identity formation" (abstract). Barton (2002) argues that when an educator values students' perspective in science education all students can benefit greatly. If students can see value in what they learn and can imagine how more knowledge about a topic can improve their lives (community, family, health or social status), they are more likely to engage in the material.

Barton's most recent work examines the relationship among environmental justice, activism, and science education, a logical progression considering her scholarly evolution and the current politics of climate change and sustainability. In 2010, Barton published a piece that outlines how "environmental issues are framed across race and class" (p. 209). In this piece

Barton explores how students in an after school program learn about sustainability and energy in a way that allows them to be spokespersons, community leaders and expert activists on a topic in which they have firsthand experience. Students participated in a program that took place in a building that had recently been installed with a green roof (where grass or plants cover the roof). Barton (2010) documents how students learned about green technologies, developed a proposal to the owners of the building and were able to acquire a new green roof on the building. She notes that the process of identifying a problem in the community (the roof is leaking), participating in activism in science (creating a proposal and getting the community involved) led students to engage fully in science lessons related to carbon footprinting and sustainability and connect it to issues of urban design and discussions of socioeconomic status in the context of global sustainability.

Environmental Education and Digital Media

In addition to Barton's scholarship, I incorporated ideas developed by other scholars who have researched how water science environmental education programs impact participants' attitudes and behaviors. For example, Kwan and So (2008) invited 11 and 12-year-old students to participate in a two day camp to learn about "real-life environmental issues" (p. 93). Using a critical approach that required students to conduct self designed research on their environment, Kwan and So (2008) found that "environmental learning had taken place" because students had been engaged in a problem based learning process that "empowered" students (p. 110). However they conclude that more time with students would have generated better results. In addition, Metwally et. al. (2007) provided evidence to "support the concept that water, sanitation and hygiene health education can produce a significant sustainable improvement in health

promotion" (p. 73). In this three-year study, researchers used a critical approach to teach personal hygiene, proper handling of water, and proper use of pour flush latrines. Both of these studies support the assertion that long-term engagement in an education project and the use of critical theory (discussed in chapter 3) are integral when designing an education program that hopes to yields positive results.

Finally, I drew ideas from two emerging methodologies, Photovoice and digital storytelling, developed by Caroline Wang and elaborated on by Gurbrium and Harper (2009). In Photovoice, participants use cameras to document a theme of the group's choosing to promote discussion. For example, when participants from a Romani community in Hungary employed Photovoice, participants used cameras to document environmental and health issues. They generated photographs used to drive group discussion and create a public gallery in an effort to generate public discourse on environmental and health issues with a larger audience (Gubrium & Hapter, 2009). Digital story telling similarly asks participants to "produce three-to-five minute visual narrative that synthesize images, video, audio recordings of voice and music, and text to create compelling stories" (p. 3). Gubrium and Harper (2009) argue, "digital and visual approaches to participatory research offer opportunities to open up the ethnographic research process with a diverse array of audiences" (p. 2). Furthermore, Gubrium and Harper (2009) imply that these methodologies can be powerful classroom research tools that help participants critically examine issues in their community.

As the teacher of this course, I tried to develop an ongoing curriculum that would address several learning goals for science and social justice. This curriculum formed as I learned more about the problems in Mesolandia and as the students made their interests and concerns clear. As a researcher, I have looked back at field notes and archival data to define objectives that

taught science and social justice and the corresponding activities. Activities and objectives taught in the after school program were not always taught sequentially but cyclically. I revisited and revised learning goals often, as students identified their interests and as I addressed their misunderstandings. I have included this table in my findings chapter because it is my perspective of how the course components fit together.

Table 1: Science and Social Justice Learning Goals and Corresponding Activities

Science Objective	**Social Justice Objective**	**Activity**
Students will understand the hydrologic cycle	Student will identify where water is located in their local community and predict if that water is healthy or polluted	Students will create a map of their community entitled "Where is the water?" For each body of water identified on the map students will discuss if they think the water is contaminated or not, and why.
Students will understand the geography of their country's rivers	Students will understand how their country's river system contributes to economic systems and commerce	Students observe maps of their country's river systems, read an article about how the river they live near contributes to their country's economic systems and create a visual aid and verbal presentation demonstrating how phenomenon they observe in their immediate community could also be happening nationally.
Students will define three types of water contamination: industrial, agricultural and domestic/urban.	Students will identify what types of water contamination they see in their own community	Students will use disposable cameras to document different types of contamination they see in their community.
Students will observe and explain how microscopic contaminants enter into drinking water systems and food.	Students will make recommendations to their community on how water contamination can be avoided	Students will conduct an experiment in which water, food coloring (used to represent microscopic contaminants), and a stalk of celery are combined in a cup and left for half an hour. Students will document if the celery had absorbed the food coloring. Finally, students draw conclusions about how contaminants enter into our water and food and make recommendations to their community in the form of posters. Students used photos they had taken in previous lessons to illustrate their recommendations.
Students will identify contaminants in water surrounding the community using a water testing kit.	Students will report the findings of their water testing experiment to an outside audience	Students will use a water testing kit to determine what kind of contaminants are in the standing water in the community Laguna (to where all the sewage flows)

Students will synthesize their science learning and define the environmental issues they feel are most important in their community	Students will share their science learning with their immediate community, their local peer group, and a global community of YouTube users.	Students will use the photos they have taken over the course of the project to create videos in which they will explain what they have learned about water contamination. Students will publish the videos on YouTube. Students will present what they have learned in a values forum in front of their peers from other high schools in Barranquilla. Students will hold a community meeting to teach members of their immediate community what they have learned.

This curriculum construction differs greatly from what I would have created on my first day of planning for the program. I was originally concerned with the quality of the water supply and assumed that the curriculum would include lessons on how to disinfect drinking water, how to safely store standing water, and how to prevent disease with personal hygiene lessons. I imagined that the social justice component would involve my students teaching younger students how to wash their hands and disinfect their drinking water. However, as I learned more about water and sanitation issues in the community and about my students' interests, it became apparent that an appropriate curriculum would be more focused on industrial and domestic contamination and improved sanitation. The social justice component needed to teach students how to speak to the problems they identified in their community in an informed manner. Students demonstrated an interest in sharing what they learned inside and outside of the community.

A theoretical background in critical feminist theory and environmental learning with the incorporation of digital media, helped me to develop lessons that had the potential to create a successful science learning community where students gain a better understanding of water science, their immediate environment, and experiences that can translate into activism and action. Based on this theoretical foundation, one should teach science lessons in a way that helps students be informed and empowered. This allows students to engage with community members

in discourse on the impact of their immediate environment on their ability to live healthy lives and make social gains.

Chapter 3: Methods of the Researcher

Choosing an Appropriate Methodology

When I originally planned this research project, I hoped to conduct critical action research. Critical action research involves social analysis that deconstructs power relationships and structures in a community and takes action to improve the social situation of stakeholders. Goals of action research include having shared ownership of a project, analyzing social problems, and encouraging community action in the form of social, economic and political development (Denzin & Lincoln, 2000). I envisioned a study, much like one conducted by Hoque et al. (2000), that demonstrates a cyclic approach unique to action research with a methodology that incorporates the identification of contaminants in drinking water, the development of a clean drinking water solution, and an investigation of stakeholder's interest and willingness to participate in a community developed solution. Ultimately, through this action research, Hoque et al. (2000) observed social mobilization through "planning, promotion and implementation" of community identified solutions to the water contamination problems by "volunteer women, social and elected politically leaders, schools students and health workers" (p. 489). Although I will draw from action theory during the course of this study, for this particular project, ethnographic methods are far more appropriate for the scope and development of the research. A significant crossover in the methods and goals of both critical action and critical ethnography allow for an easy transition from one methodology to the other.

Theoretical Implications of Critical Ethnography

Ethnography is a participatory research methodology that evolved from traditional social research. Weber defined "sociology as a science concerned with the interpretative understanding of social action, and social action as a behavior meaningfully oriented toward the behavior of others" (as cited in Schwandt, 2007, p. 1). It is also "often associated with social transformation in the Third-World" and community development (Kemmis & McTaggart, 2000, p. 568).

Critical research involves social analysis that deconstructs power relationships in a community and the social situation of stakeholders. Goals of critical research include having shared ownership of a project, the analysis of social problems, and the orientation toward community action in the form of social, economic, and political development (Denzin & Lincoln, 2000).

The processes of knowledge construction and attitude formation and reformation can be analyzed from many different perspectives. In this study, the approach to gathering and analyzing data was based on critical theory. This theory implies that knowledge and truth are located in "specific historical, economic, racial, and social infrastructures of oppression, injustice, and marginalization" (Lincoln & Guba, 2000, p.177). Lincoln and Guba (2000) define scientific truth as "a knowledge about reality" that "resides in rigorous application of testing" that is designed to be "devoid of human bias." They define critical theory as an approach to truth and knowledge as the "active construction and cocreation" of social knowledge that is "produced by human consciousness" (p. 176). Critical theorists do not see knowledge as an external reality but as existing within a historical reality, Lincoln and Guba (2000) elaborate:

> [T]he "foundation" for critical theorists is a duality: social critique tied in turn to raised consciousness of the possibility of positive and liberating social change. Social critique may exist apart from social change, but both

are necessary for criticalist perspectives (p. 177).

Social knowledge and truth is created from the daily experiences of individuals and groups. Therefore, critical social scientists aim to incorporate theory and practice in order to increase awareness of the inconsistencies in a belief system and inspire an individual or group to change those practices that are counterproductive to their quality of life by engaging in praxis and social action (Schwandt, 2007). Schwandt (2007) explains that social change does not happen by exposing or enlightening a group to a set of external standards but by challenging their belief system by "showing that these practices do not measure up to their own standards are internally inconsistent, hypocritical, incoherent, and hence comprise a false consciousness" (p. 53-54).

Critical researchers attempt to deconstruct how social institutions create structure in a society or community. One possible benefit of critical ethnography is catalytic validity. Kincheloe and McLaren (2000) argue that critical ethnography can move "those it studies to understand the world and the way in is shaped in order for them to transform it" (p. 297). Students may benefit from what they learn in youth group settings and apply their knowledge to their immediate community. This benefit may be in educational attainment, health, or quality of life. Students are also eligible to earn social service hours for their participation in the after school program that they need to graduate from high school in the Colombian school system

During a college anthropology course I was riding from one Mayan village to another in the Yucatan peninsula and was astonished and disgusted by the heaps of trash along the road. My professor told me that people had been dealing with their trash the same way for hundreds of years by dumping it outside of their cities. However, even thirty years ago all of their trash was organic. Even glass breaks down after enough time. With the invention of plastic, the trash system changed completely. Suddenly the trash piles do not break down at the same rate they

had before and yet people kept disposing of their trash in the same way. In this case, a critical ethnographer would identify how communities form ideas about sanitation and trash disposal, where those ideas are rooted (trash decomposes, we have been putting our trash in the same place forever), why those ideas are now hypocritical and destructive (the Mayan people are farmers who need the soil to be fertile and healthy to grow crops), and use that foundational and internal knowledge to alter the trash condition (start a cooperative that uses recycled goods to bring profits to the community). My approach was similar in Mesolandia.

During the course of this research, I used a critical ethnographic approach to investigate young adults' changing knowledge about water science in a highly disenfranchised community near Barranquilla, Colombia. Critical ethnography integrates "theory and practice in such a way that individuals and groups become aware of the contradictions and distortions in their belief systems and social practices and are motivated to change those beliefs and practices" (Schwandt, 2007, p. 51). By utilizing research results in a way that participants "gain self-understanding and self-direction", critical ethnography does more than display the results of the inquiry process (Kincheloe and McLaren, 2000, p. 297). In this study, I acted in a participatory manner to understand how knowledge acquisition by members of an after school program group might translate into motivation, mobilization and awareness about water and sanitation within the immediate community.

Methods

As a critical ethnographer, each week I visited Mesolandia each week for two hours to teach the afterschool science program. I taught science lessons, took field notes during student work time, and expanded those notes on the bus ride home. I also collected all completed

student work each week to scan, catalogue, and use as archival data. Finally, five consenting student participants took part in one or two 30-minute interviews during the study. These interviews took place after our normal meeting time in Mesolandia. All archival data, interviews, conversations with the principal in Mesolandia, parents meetings, and student work were originally in Spanish and translated into English by me. Because I am not a native Spanish speaker, I often asked Colombian colleagues to help me understand the meaning of local colloquial phrases with which I was unfamiliar. I used Google to translate unfamiliar vocabulary. In Table 2 I have outlined when each piece of data was gathered.

Table 2: Audit Trail

Date	Day	Field Notes	Archival Items and Interviews
9-1-10	1	✓	Questionnaire and short writing exercise
9-8-10	2	✓	Maps
9-15-10	3	✓	Photos from disposable camera activity
9-29-10	4	✓	Posters
10-6-10	5	✓	
10-20-10	6	✓	Graphic organizer about types of contamination
10-27-10	7	✓	Graphic organizer about types of contamination
11-3-10	8	✓	Graphic organizer on sub-problems and creative solutions
11-10-10	9	✓	Photos from second disposable camera activity as well as water testing photos and results
11-17-10	10	✓	YouTube videos and scripts from videos
11-24-10	11	✓	
11-25-10	12	✓	Recorded conversation with parents Interviews with Cristina, Jorge and Jaime
12-1-10	13		Graphic organizer to guide end of year reflection
2-7-11	14	✓	Letters to authority figures
2-14-11	15	✓	Meeting with mothers, introduction to new students
2-28-11	16	✓	Practice session for values forum

3-14-11	17	✓	Interviews with Maria Fernanda, Sheryn, Jorge and Jaime
3-27	18	✓	Voice recordings, reflection on photographs
4-4	20	✓	Graphic organizer on sub-problems and creative solutions
4-8	21	✓	Video and PowerPoint from Values Forum

After transcribing the interviews and field notes, I unitized the data in word documents and printed each data unit onto a separate data units printed on notecard. These notecards, along with pictures and student work were categorized into thematic piles. Finally, I coded these piles with descriptive labels and from these piles analyzed theoretical implications and research findings. As an ehtnographer I was concerned with discriptions of the setting, the process of entering the community, the devlopment of the curriculum, student responses to specific science lessons, student leadership development, tracking the evolution in researcher/particpant and interstudent relationships over a long-term engagement, and assessing student sciene knowledge levels.

Consent Procedures

I selected participants for this study from high school aged students who choose to participate in an after school program originally sponsored by the organization *Punto de Encuentro*. This independent non-profit organization provides humanitarian aid to communities in need and assists community members in their effort to improve their socio economic standing through education and community engagement. In Mesolandia, three community groups, the Senior Citizen Club, the recreation club, and the young leaders youth group currently meet on a regular basis. The goal of the organization is to "improve the living conditions of vulnerable populations through providing comprehensive care for the elderly, women and children" (*Punto de Encuentro*, n.d). *Punto de Encuentro* describes Mesolandia, Malambo, as a community

"where there is a high proportion of vulnerable and displaced people where poverty, violence and frequent flooding are common problems" (*Punto de Encuentro*, n.d). Students have named the after school group *Clase Aparte* (A Class Apart) and consider themselves *jóvenes líderes* (young leaders) in the community.

Data from five long-term participants were gathered over a seven-month period, from September 2010 to March 2011. Although the size of the youth group fluctuated significantly during this time period (from four to fifteen students on any given meeting day), these five students attended meetings regularly from September 2010 to March 2011. I informed students about the research and they were given the opportunity to participate. I reassured students that participation in the study would not affect their ability to participate in the after school program and presented students and their mothers with a written consent form in Spanish. Additionally, I verbally presented information about the study to students and parents due to the possibility of limited literacy within the community. I digitally recorded parents giving verbal consent for their child to participate. In addition, parents and students signed a media release form so that digital media created by the group might be published on the internet, presented in public forums or used for the purposes of this research project. I made it clear that participation was voluntary and a participant could withdraw at any time without penalty.

I excluded data gathered from students who did not give personal consent or whose parents did not to give consent for the research component. In cases where parents were not able to attend the research consent meeting but signed the media release form, only digital media collaborated on by groups of participate and non-participant students was considered for data analysis. Therefore, the data used in the findings from the study come from the five students profiled below.

Participants

Sheryn is *Clase Aparte's* fearless leader. She never missed a meeting until early March and has done more for recruitment and retention in the group than I could have ever accomplished alone. With her leadership, the group has grown significantly. She has even recruited students from outside Mesolandia. Sheryn is perceptive and has a dry sense of humor. She is especially stern with boys, but they always do what she asks of them. One afternoon, when she was walking me to the bus stop, she told me about some of the girls in the community that were pregnant. She raised her eyebrows, pursed her lips, and told me that would not be her. Her dad, who no longer lives with her mother, had promised to pay for college. She was not going to have a baby until she finished school. Sadly, the reason she missed the meeting in early March was because Sheryn's mother has pulled her out of school to take care of her infant son, Sheryn's brother. When I saw Sheryn in February 2011, she brought her baby brother to the meeting. She looked years older than when I saw her in November. She had dark circles under her eyes and didn't smile much. She was attending school on Saturday mornings, she told me. When I questioned about her further, she raised her eyebrows, pursed her lips, and told me she would be graduating in one year, no matter what.

Cristina is the group's informant, dictionary, and translator. When I do not understand a word or part of the discussion she gives a little sigh and tries to explain to me in another way. She is responsible and has taken a leadership role in the group. Cristina can be very demanding but when her demands are met she often acts disinterested. For example, when preparing for the values forum Cristina was very concerned about how the group would dress. Because Sheryn is no longer in school, she does not have the school uniform. Therefore, Christina informed me, we would need to come up with a new plan. When she came to speak to me about this issue in

March 2011 she was very strategic. She explained that because the group had already done two presentations in the community, and the values forum would be their third, that they would have earned their group shirts at the end of the forum. Therefore, she argued, they should get them one day early. After I said that they could have their shirts to wear for the forum, she told me that she did not like the color of the old shirts, or the design. "We already decided that we would like green shirts with a hand holding a world as our symbol and a big *Clase Aparte* above the world." I went to the shirt company with Cristina's design and begged them to have the shirts made by the day of the forum. When the group arrived on the day of the final presentation, I presented Cristina with her shirt first, seeking her approval of the logo. She gave a slight nod, said thank you, and went to the bathroom to change. Cristina does not radiate excitement about the group but she comes every week. Her attendance is her demonstration of respect and involvement with the group.

Jaime is the group's English enthusiast. He loves our end of class English lessons we discuss his English homework as we walk to the bus stop. Jaime has a suspicious smile and can always be counted on to make a joke. He is the first to pick up on my speaking ticks. He loves to repeat the way I say, "okay?" At first I thought he was mocking me but later realized he was just trying to get the connotation right. Jaime is at every meeting and, although he can be silly and distractible, he often contributes to the discussion in meaningful ways. I think Jaime has found his voice in the group and realized that he is good at public speaking. In February he was elected *personero* of his school, which means he serves as a liaison for the students to the administration. In October 2011, it took a significant amount of effort to get Jaime to talk in front of the group or teach new students about what we learned. By March, his confidence in his ability to charm audiences was unrecognizable. Now, when he speaks in front of a group he puts his shoulders

back and projects his voice. He only shows that he is nervous when his knees jitter ever so slightly. However, he still gets very uncomfortable in front of my interview microphone.

Jorge was the most difficult student with whom to build a relationship. He looks tough and is bigger than most of the boys in the group. I do not remember seeing him smile until February. Nonetheless, Jorge contributes greatly to the group. He only speaks when he feels he has something to say. His voice is a little quieter and squeakier than one might expect but he speaks with authority and confidence that he can be quite convincing. He had become the group's expert on industrial contamination. When we practiced the values forum presentation, he stood without moving at the front of the room until it was his turn. Then, he took one big step forward and spoke directly to the audience. I only see this kind of intellectual confidence in Jorge when he speaks about industrial contamination.

Maria Fernanda is Jorge's little sister and is not supposed to be in the group because she is only in the ninth grade. She just started showing up with Cristina and never stopped participating. Maria Fernanda is the baby of the group. She is bubbly, excitable, and participates in every activity with enthusiasm! She is the foil of her older brother. During the process of preparing for the values forum, Maria Fernanda began to recognize her talent for engaging audiences when she speaks. During one practice session, she surprised herself when she asked the audience a question and they responded. I think she expected the questions to be rhetorical.

Jorge and Maria Fernanda live in a house with their parents, their grandparents, two other brothers, three uncles and an aunt. Their immediate family shares one room. They sleep together and bathe together when there is water. Their mother is the most involved with the program. She contributes by organizing parent meetings, communicating with the principal, and supervising fundraising efforts.

In this critical ethnography, I will trace the evolution of changing knowledge and attitudes of the five participants described above over the course of a nine-month study. I gathered data in the form of field notes, interviews, and archival data. This data demonstrates that students' knowledge and attitudes about science and social justice changed significantly from September 2010 to March 2011 because of particular curriculum strategies, the use of digital media as a learning tool, and the length of time of the project.

Chapter 4: Findings

In this chapter I discuss how the data demonstrates changes in students' attitudes and perceptions related to their environment and how they feel about their ability to make positive changes in their community. For each of the goals of the after school program, I give examples of how certain objectives were taught and then analyze students' responses to these lessons. Then, I draw more general conclusions about how each of these objectives affected students' attitudes and perceptions with a specific focus on the benefits of using digital media and of long-term engagement in a community. Additionally, I compare the components of the program to analyze the benefits and downfalls of each, discuss the limitations of the study, and make recommendations for how a more successful program might be developed. Finally, I discuss how my role in this project as foreigner, teacher, and researcher might have influenced the results of this project.

Environmental Science and Social Justice

Map Making

During this study, each of the five participants demonstrated some change in knowledge of water science. However, this was far less apparent than the connection students made between living in a contaminated environment and their quality of life. In a questionnaire students filled out in early September, they did not indicate concern or a significant amount of interest in discussing their daily uses for water. One question asked students, "How much water do you drink every day." Three out of the five students left it blank or wrote, "I don't know". None of the students indicated that they filtered or boiled their tap water. They also gave no indication that there were ever any problems with water service, paying the water bill or buying water from the store. I imagined that water service was not always reliable and that the price of

water may have been too expensive for some families to pay. I recently read an article that claimed people in Barranquilla who qualify as strata one on the one to seven socioeconomic scale in Colombia, pay as much for water as people with a strata four status in other Colombian cities (Mora, 2009). This prediction was unconfirmed after this meeting. All five participants did indicate that water they kept covered the water stored in their house but did not demonstrate knowledge about the health benefits of covering standing water.

In the following meeting, students again seemed puzzled by my interest in talking about water in Mesolandia. I never directly asked students about contamination or used that vocabulary until we defined different types of contamination later in the program. I did this for two reasons. First, I wanted student concern and interests to drive the action plan. Second, I did not want to make assumptions about the community that I had not verified. Although I knew at this point that some houses had tap water but few houses had bathrooms, I was not sure what the most pressing environmental issues were in the community.

During the second meeting, I asked students to use a large poster board to make a map of their community. They titled the map, "Where is the water?" Students first mapped the boundaries of Mesolandia before filling in important places, like their school and where they might see water. Students worked in pairs to map the community. They were unsure how to progress at first so I began drawing the boundaries of the community to demonstrate. Because they know the geography of their community much better than I do, they were able to begin correcting me when I was wrong and eventually took over completely.

Figure 2: Student drawn map

Student pairs made maps that were different in terms of proportions. As they made their maps, they would look up into the air to visualize different streets and what they might see on the street. They would ask each other what type of business was located in certain buildings and seemed curious to know more about their surroundings. When the lesson was over, Sheryn kept noticing things she forgot to put on the map and talked about how she would draw the map if she could do it again.

The first recognition by students that they live near polluted water happened when students began filling in the water on their maps. First the students identified the river as the main place they see water. Then they began to talk about all of the other places they see water. On the map, they labeled *charcos* coming out of the cargo company's land, the chicken processing plant, and from houses. They explained that streams coming from homes and companies flow directly into the river. They described the water coming from the two companies' properties as black and malodorous. Cristina described the water coming from the

chicken processing plant as black and full of *desechos* (this word translates as "toxins" but the students also use it to describe parts of dead chickens). They also talked about the dirty water that leaves from the houses. They explained that almost all the houses in Mesolandia have drinking water connections inside their homes or at near by houses. However, no houses connect to a sewer system or have access to waste services of any kind.

Through this activity students began to identify problems in the community related to water and sanitation. They also identified industrial contamination as an issue. The realization that students were concerned about industrial contamination influenced how I planned future lessons. Because I felt the lesson had been effective in helping students identify possible topics related to health and the environment, I planed a similar lesson for the next week.

The Hydrologic Cycle and the Geography of the Magdalena River

The lesson second science lesson I taught focused on the hydrologic cycle and the geography of the Magdalena River. The lesson started with a question and answer session to determine prior knowledge. I asked the students, "Where does the Magdalena River begin and end? What happens to the water when it leaves the river? How it leaves the river? And, what happens to the river when it rains?" To each question, the students responded with incorrect answers or did not know. It was unclear whether students were disinterested in the topic or unsure of how to respond. Because this lesson took place so early in the study, it is also possible that students did not understand what I was asking because of language limitations or did not feel comfortable engaging in a discussion with me. I had also failed to establish a classroom culture where making mistakes was expectable (this became a focus of meetings later in the study). However, I was surprised when Jaime predicted the Magdalena River started somewhere in the

state of Atlántico, near Barranquilla, and no other student volunteered another answer. This demonstrated a significant misunderstanding of the river's geography. I had expected students to be unsure of the river's geography because I had never seen a map at the school but I did not expect for students to have no geographic base. I also asked students to consider how big companies, like the ones they drew on their maps the previous week, are located along the river and how they use the river to ship goods in and out of Colombia.

After posing these questions, I provided students with literature to help them answer the questions I posed in the first five minutes of class. I gave student printed material to examine in order to create a poster titled, *De donde viene el agua?* (From where does the water come?) I wanted students to take the information and create a visual aid that combined the ideas of science (the hydrologic cycle) with economics (how companies use the river for commerce). I also asked them to imagine how the use of the river by companies could affect its quality of the water.

The desired conclusion was that students would recognize that the degradation of water resources in their community is part of a larger problem. Each group of three was presented with one page of information on the hydrologic cycle, a map of the Magdalena River and an article on cargo shipping. Unfortunately, the lesson was poorly executed. It appeared that students were overwhelmed by the amount of reading they were asked to do in groups (about three pages). Students seemed disinterested in the reading but were fighting over the maps.

The only indication found in the data that students learned something in this lesson was the use of vocabulary like "ecosystem" in discussion and when they made posters to hang in the community. In addition, Sheryn demonstrated an understanding of river geography in a discussion about whether they should use the name of the chicken processing plant in their

presentation at the values forum. In this discussion, Maria Fernanda suggested that we name the company. Sheryn responded, "this is not just one company, it is many companies, too many who contaminate!" This ability to visualize similar scenarios of what is happening in Mesolandia on a national level may have come from themes discussed in this lesson.

Polluted Food and Water

During our fourth meeting, I taught an ecology lesson that focused on how food becomes polluted with chemicals, hormones, bacteria and virus we cannot see with our eyes. Each student received a plastic cup with clear water. As we talked about the kinds of pollution we see in Mesolandia, we added food coloring to represent the different types of pollutants. When they were satisfied with their colored water we placed a green onion in the water (the experiment calls for celery but I could not find it at the store the day before). We sat the cups aside, had a lesson and then brought the cups out again after about 15 minutes. We then used a knife to cut off slivers of the onion and identified contaminants (different colors) we could see in the onions. In just 15 minutes the inside of the onion from the bottom to the top had absorbed the colors in the water. The students were surprised that in such a short time the onion had absorbed so much of the color.

This was a short lesson in a day where students did several team-building activities, an English lesson, and made posters to hang in the community. Nonetheless, several of the students made reference to the experiment in follow up interviews. Additionally, students reported that they described the experiment in a community meeting they held in December 2010. After this lesson students began to understand that pollution is also invisible. Before this lesson students demonstrated an understanding that trash on the ground could cause potential environmental and health problems. In the meetings following this lesson, students began using the vocabulary

"toxic waste" in discussion, interviews, and in a poster making activity. In this activity Sheryn wrote, "When we contaminate the water, we contaminate ourselves." When asked to explain this statement she referenced the onion science experiment.

Types of Contamination

Although we had been talking about pollution we could see in the water, I did not define different types of contamination until our fifth and sixth meetings that took place in October 2010. This lesson asked students to create a graphic organizer for a different type of contamination. The students were given four paragraphs to read on industrial contamination, agricultural contamination, ocean contamination, and domestic/urban contamination. Based on the written definition, they selected the type of contamination they felt was the greatest problem in Mesolandia. Each student made their selection privately based on their experiential knowledge of contamination in their community. Then, in one corner of the graphic organizer they drew how they visualized contamination in Mesolandia. In the second quadrant, they defined the problem in their own words, in the third quadrant, they listed the types of things that constituted this type of contamination and in the last box, they drew a solution to this type of contamination. Four of the five students choose to write about domestic/urban contamination. Only Jorge choose industrial contamination. I found this surprising considering so many of the students' conversations were related to what they believed was contamination coming from the companies near the community and the chicken processing plant in particular.

In Jaime's graphic organizer he wrote, "domestic and urban contamination can be found in almost all parts of Mesolandia." In his drawing of the problem he drew a house with a puddle full of trash and dead fish in the front and dead trees on the side. In his picture of a solution the trees were alive and the water in front of the house was filled with live animals. Sheryn also

drew a house with trash filled water in the front. However, in her drawing the trash spills out of the water and surrounds the trees in the community. She wrote, "In the streets, in the houses and in the water [contamination can be seen]. We can find tons of contamination in Mesolandia. A huge amount of contamination." Maria Fernanda drew a similar picture but contributed the number of bugs to the surrounding contaminated water. She wrote, "When I pass the Laguna I see left over food, toxic waste, and plastic residue. The smoke and odor from the chicken processing plant contaminates Mesolandia and… kills the trees." Wendy's picture shows water flowing from a house. She labeled the water, "dirty with soap." She also drew a picture of cigarette butts and soda bottles. She wrote, "First, many of the streets are full of contaminated water and because of this the grass is covered with food wrappers and bottles." Jaime (who focused on industrial contamination) drew a picture of trash floating in the river. He wrote, "Behind the chicken processing plant and the cargo company because they work with many chemicals."

This lesson proved to be an important turning point in the students' knowledge base and interest in the project. Students retained and used the vocabulary introduced in this lesson in independent writing activities, the scripts for their YouTube videos, and in interviews in December 2010 and March 2011. For example, in a November interview with Jaime, I asked him, "What type of contamination is most common here? He responded, "industrial contamination." I then asked, "What types of things contaminate the water?" He said, "The trash people throw from their house into the streets. Like when people are walking and eating something and then they throw the wrapper into the water as they walk." When I asked him to define this type of contamination, he responded, "domestic and urban… I observe this type of contamination all the time in the neighborhood when I am walking in the streets and see it in the

puddles outside of the houses and it really smells. What does this say about our neighborhood?" Jaime is identifying an environmental problem and a social issue related to contamination. After this lesson, he began to make connections between the environment and the right one has to live in a safe and sanitary environment.

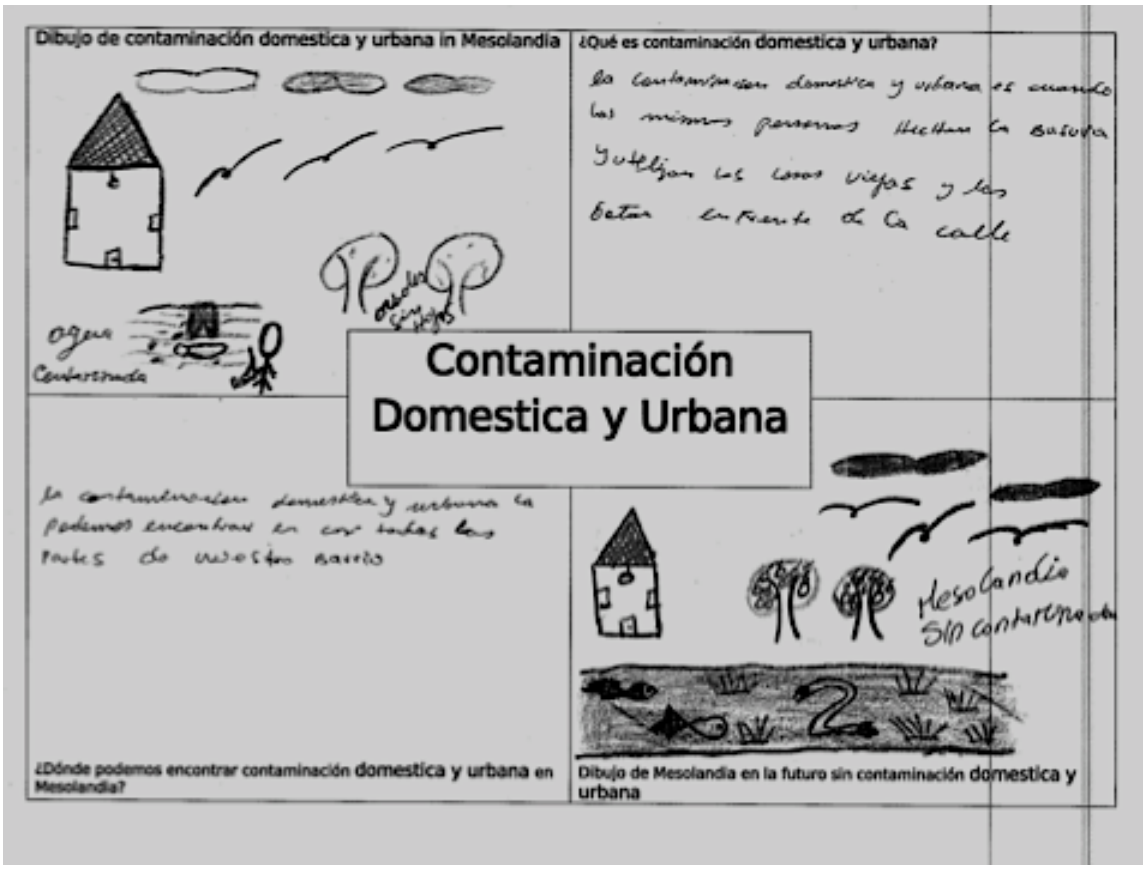

Figure 3: Domestic and urban contamination graphic organizer

Jorge also talked specifically about industrial contamination in interviews conducted in November and March. Cristina discussed industrial contamination and domestic contamination in her November interview but did not use this specific vocabulary. However, all five participants demonstrated in class discussions that they had retained this vocabulary, could give definitions of both types of contamination, and could explain to other students where they could find this type of contamination in Mesolandia. Finally, the photographs the students took of

different types of contamination in two separate activities demonstrated they could identify and document domestic/urban and industrial contamination in the neighborhood. This evidence will be elaborated on in the following sections.

Sub-Problems and Creative Solutions

In the week following the lesson on types of contamination, I asked the students to work in groups of three to complete a graphic organizer. They were to take the problem and solution they drew last week and break down those into three sub problems and solutions to those sub problems. The goal was for them to think of creative solutions to the problems. For example, some communities in Colombia are using plastic bags to create *eco-mochilas*. Colombian men and women carry *mochilas,* a traditional bag with a single strap attached to a hive shaped sack. Both these traditional bags and then sell the bags to raise money for their community. Other groups turn trash into art (bottles into decorated vases and cans into piggy banks).

Several new students joined the group for our eighth meeting. I saw this as an opportunity for the veterans of the group to practice teaching what they had learned in previous lessons. I asked Jorge, who had shown an interest in industrial contamination, to explain to one of the new students what he had learned. Jorge is a very quiet, generally unresponsive, young man. For the first four weeks of class he showed up late and had very little to add to the conversation. This day, however, when prompted, he turned to the new student and in a very quiet but confident voice defined industrial contamination. His explanation was not only technically correct but included his opinion about how industrial contamination effects Mesolandia. His confidence and use of science vocabulary indicated an increase in knowledge about science and a connection to social justice that I had not seen previously from Jorge.

Jorge continued to demonstrate an interest in industrial contamination in interviews and written assignments throughout the rest of the study. Jaime and Jorge worked together with the new student on the graphic organizer. They identified the larger problem as "industrial contamination" and the sub-problems as air pollution, the way in which companies dispose of chemicals, and toxic waste that they dispose of in the river. All of their solutions dealt with proper disposal of industrial waste. Jaime and Jorge demonstrated and understanding of the definition of industrial contamination but did not provide evidence that they felt they had the power to help reduce industrial contamination in Mesolandia.

Sheryn demonstrated in this activity that she was beginning to see connections between environmental problems and activist solutions. See Figure 3. Sheryn defined the problem: "the trash and food residue that you see all over the roads." She identified the sub-problems as the burning of trash, the contamination by the chicken processing plant, and "*zanjas*" (hand-dug ditches that serve as sewers). See Figure 4. Concerning these problems, she concluded that if the trash did not accumulate it would not need to be burned, that an agreement should be made with the chicken company saying the company would stop polluting and that people should stop throwing trash into the streets. She also suggested that people use less water so that the *zanjas* will not overflow. Finally, she concluded that these solutions would only be possible if all of the habitants of the community could get together to talk about the problems without fighting. In the middle of October 2010, Sheryn's ideas of how to solve contamination problems showed an increase in interest in the social justice component of the project. However, her ideas about community organization and communication developed significantly by March 2011 when she participated in a closing interview.

In this interview with Sheryn and Maria Fernanda, we discussed the problems with water services that have been degrading since December. In the past few months, water service had been compromised in many parts of the community. Beginning in December 2011, tap water was yellow, was not drinkable, and was only available at the tap a few hours a day, if at all. Because of this, people stopped paying their water bill. Sheryn argued, "why is my mother going to pay for water if we are not getting any water." What has resulted is a vicious cycle of the water company insisting that families owed four months of water bills and families insisting that they should not have to pay for water that was not available to them.

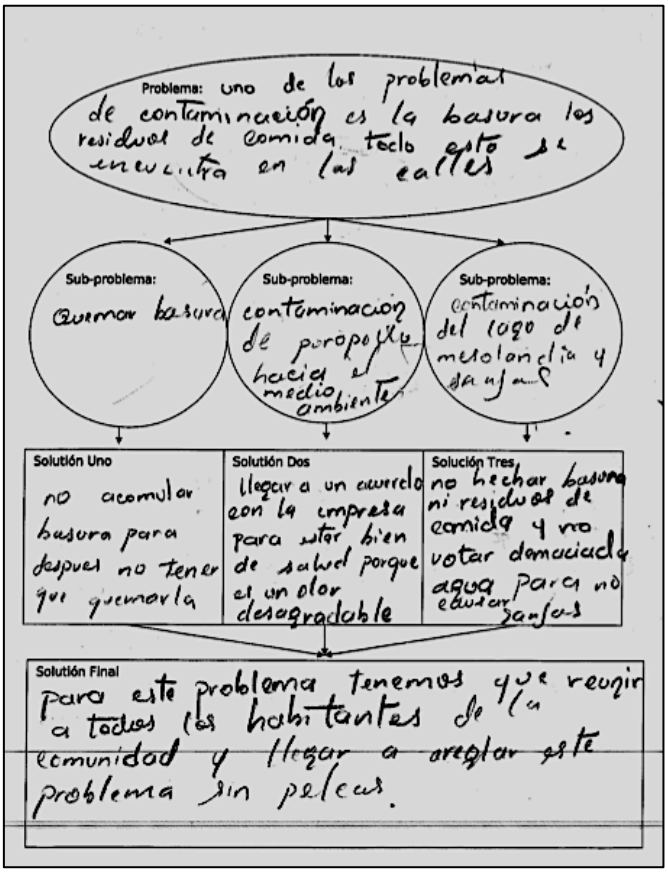

Figure 4: Problem and sub-problem graphic organizer

It was at the end of this conversation when I asked Sheryn, "Now that you know more about the environment and how to change things here, what are you going to do with the new

information?" She responded, "It is not enough for us to present at the values forum. We have to talk to the people here. We have only held one community meeting. We still need to inform the entire neighborhood by organizing a campaign or something similar to teach them. This is just as important to us as the values forum." Earlier in the interview, Sheryn also demonstrated an increased understanding of the benefits and consequences of public demonstration. Maria Fernanda broached the topic when she said, "some times the service are so bad here that the people protest because they can't take any more, so they block the highway. One day, for example, after four days without electricity, they (people from the neighborhood) took the highway." Then, Sheryn made a perceptive interjection to inform me that the protest took place because "it was not the rainy season" so it was very hot and, without electricity to run fans, people were getting sick (possibly with heat stroke).

While Maria Fernanda went on to describe the protest, Sheryn continued to justify the protest. She insisted, "the people only protest when they have a good reason." However, when describing how the anti-riot police infiltrated the neighborhood and threw tear gas in front of all the homes, she said. "I was choking and crying as well like all of the other innocent people who didn't go there (to close the highway)" but who still felt the effects of the tear gas. It is interesting that Sheryn described the people who did not participate in the protest as "innocent." However, she goes on to again validate their actions. She argues, "The people have a reason to protest because one can not live without water. How is one to live without water when they do not have enough money to buy water?"

Figure 5: Examples of Zanjas

In Sheryn's work from October, she suggests a peaceful community meeting as a solution to environmental problems in Mesolandia. In March she demonstrated a new sophistication in her ideas about activism and change by analyzing previous protests she had witnessed in the community and by calling for an educational campaign to move forward with the goals of the after school program. She elaborated on these ideas later in the interview. "The people have to be conscious of this…we (in the youth group) already know (about the environment) because you came with this project. However, all of the Mesolandia community needs to know…. It is necessary to communicate to the rest of the community the things you have taught us. This is important." Although, Sheryn did not elaborate on what specific things I had taught her, and I did not ask, this statement demonstrates that she believed she knew more about environmental science and social justice than she did at the beginning. She also added, "I have to admit I used to throw trash on the ground but now I know better."

Maria Fernanda also demonstrated an increased knowledge of environmental issues but did not give any indication of how an activist might approach these problems. However, she did propose reasonable solutions to her sub-problems. She defined the larger problem as "people all over the neighborhood throw lots of trash in the front of their houses." She identified throwing

trash in front of the house as a problem and proposed the installation of trashcans in the neighborhood. She also noted that the municipal garbage truck did not come to all parts of the community and suggested that a more comprehensive route to pick up trash would decrease the amount of trash in the streets. Maria Fernanda also thought "contaminated water coming from houses" was a problem but her solution was to "avoid unnecessary contamination." Her overreaching solution to the problem was to "have a clean neighborhood without any type of contamination." Maria Fernanda clearly demonstrated an understanding of domestic contamination and she proposed realistic solutions to these problems. However, she did not indicate that she believes she has any control over these problems. In a March 2011 interview, Sheryn and Maria Fernanda demonstrated significant growth in their understanding of social justice. At this point in the program, she had only attended two meetings.

Five months later, in the March interview, Maria Fernanda demonstrates a changed understanding of the potential role she can play in making changes on the community level. When I asked her how she would use the information she learned in class in the coming year, she responded, "First, we will present in the values forum so people from all over Barranquilla can see how we are living. After they see how we are living they will help us deal with contamination issues in Barranquilla and make it a better city." With this statement, Maria Fernanda notes the importance of sharing information with an outside audience and the benefits of adding human touches to a presentation to trigger an emotional response in her audience. I interpreted both of these assertions to be examples of an increase in understanding about social justice.

Cristina identified the three sub-problems that contribute to urban contamination as trash, dirty water, and organic wastes in the streets of Mesolandia. She suggested that each house have

a trashcan, that the government installs a sewer system in the neighborhood, and that there be a specific location in the community to leave organic waste. She suggested that a solution to these problems be achieved by "communicating with people in *charlas* (community meetings) to stop the contamination." In this exercise, Cristina demonstrated a basic understanding of environmental and social justice issues.

Water Testing

In the beginning of November, I attempted to have the students use water-testing kits to determine the quality of the water surrounding the homes. The kit included tests for dissolved oxygen, coliform bacteria, pH, turbidity, phosphates, and other factors (see Figure 5). I believe this would have been a more effective lesson had it been better executed. I divided students into three groups of three or four students and gave them the supplies to conduct different water quality tests. However, during the testing we ran out of time. Additionally, several of the tests took a few days before the results could be determined. I left the kit with the students to finish on their own. We were to discus the results in the following week when the students came to visit Parrish. This never happened. Students forgot to bring the kit back for two weeks and failed to document the results of the testing. This was my fault as their teacher and I ordered a second water quality test to repeat this exercise. I did this even after the failure of the first lesson because the students gave indications that this exercise increased their interest in science learning. Although no evidence demonstrated an increase in science knowledge, students have mentioned in conversations and interviews that they enjoyed this activity. For example, when asked about the most important thing he learned in the program, Jorge responded, "when we learned about contamination, like the time we went to the bay and did the experiments where we dropped a pill in and it changed the color of the water." This activity has potential to increase

science knowledge and interest in science learning. However, due to poor teaching execution, students only demonstrated an increase in interest but no increase in knowledge about water science.

Figure 6: Students using water-testing kit

Science Learning, Social Justice and Digital Media

In notes from my first day in Mesolandia I wrote, "Order disposable cameras." I recognized that it would be difficult to understand the magnitude of ecological problems in Mesolandia without visual aids and evidence. However, what became apparent throughout the course of this study was that the use of cameras, audio recordings, and other digital media technologies was integral in developing students' leadership and communication skills. The use of these technologies helped students learn how to engage a larger audience in discourse on how their immediate environment affects their quality of life. With the use of digital media, students were able to document what they believed were environmental problems in their community,

illustrate these problems with posters that they hung in Mesolandia, and engage community members in their discussion using photographs they took. Students voiced their perspectives in the form of YouTube[6] videos and taught their peers using videos and photographs in a public presentation at a citywide values forum. Not only was the use of digital media an important part of moving towards the end goal of the project, it was also a substantial teaching incentive that helped students engage in the project, gave them a feeling of importance, and helped them imagine speaking to an audience that would listen.

The use of digital media as an emerging research methodology is increasing as technologies become more affordable and available. Researchers are using digital media in methodologies termed Photovoice and digital storytelling. In Photovoice, often used in applied disciplines like public health and education, participants learn photography techniques and ethics before they use cameras to take pictures based on a theme decided by the group. Then, participants choose one of their pictures to discuss in a group session. Practitioners of this methodology believe that having a self-produced visual aid helps participants verbalize their thoughts and feeling about the discussion topic. I certainly felt this was true with my students.

Digital media and social networking websites are being used more often in social justice and human rights campaigns. Oral history and storytelling have been used by cultures for thousands of years in the form of fables, bedtime stories, and songs. However, in the 21st century and with the invention of the Internet, cultural sharing is taking a much different form. According to Facebook.com, over 500 million people have active Facebook accounts (only two countries, China and India, have populations larger than that number of people using Facebook) and millions of people use Twitter, Skype and YouTube on a daily basis.

This is true in Mesolandia. For example, Marta, the principal of the school, has given me her email address five times and each time I try to email her, I get a returned mail reply. Still she insists that it is a working address. Perhaps her inbox is full or her settings do not allow me to email her but she cannot seem to make it work. However, in my effort to get back in touch with the students during their Christmas break I found Marta on Facebook and she accepted my friend request within a few hours. I found it shocking that I could not navigate an email exchange with Marta but via Facebook we were connected within hours. The power of Facebook for networking and communicating is increasing each day as more people sign up for accounts and as it is used in ways that are more meaningful.

The way students want to share information is evolving so quickly it can be difficult to keep up. Moreover, social networking sites are used more often for information sharing, organizing, and making social changes. Two articles I have seen (seen rather than read because online articles so often are accompanied by a gallery or photos or a supplemental video) demonstrate the specific potential of the Internet to create rapid and equalizing social change. The first was that of Ted Williams, a homeless man who became famous overnight for his perfect radio voice. Williams held a sign on a street corner that said he had a famous voice, a local reporter took a video of him speaking, posted it on YouTube and, overnight, it became a phenomenon. Williams then signed a contract with MSNBC and became an international sensation (unfortunately Williams is now in rehab and has lost his job with MSNBC). YouTube made this possible.

A more serious example was from an article on how Facebook and YouTube played an enormous role in the recent Egyptian protests and anti-government movement. Preston (2011) describes how Egyptian policemen publically beat an Egyptian man to death. Within a week of

the man's death a Facebook page was created to share cellphone photos of the man with his family beside those taken after his death of his "battered and bloodied face" and YouTube videos of the beating began to circulate (p.1). Preston (2011) writes:

> It became and remains the biggest dissident Facebook page in Egypt, even as protests continue to sweep the country, with more than 473,000 users, and it has helped spread the word about the demonstrations in Egypt (p. 1).

These examples of academic, journalistic, and public uses of digital media and social networking websites demonstrate how rapidly information sharing is evolving. I found that the use of digital media as a teaching tool was imperative in a program that intended to combine participant science learning with social justice action.

Disposable Cameras

The first activity in which students used digital media was in an activity that used the digital cameras I had ordered after our first meeting. On this day, the students trickled in a few at a time with most arriving late. This was our fourth meeting and we were still navigating issues of motivation, trust, and engagement. As I sat on the patio of the construction site (soon to be school) and waited with Sheryn and another student, I took out the English worksheets and disposable cameras. Sheryn took the camera out of the box, unwrapped the aluminum, and before I could stop her, started tearing into the paper part of the disposable camera. When I looked over, I yelped and grabbed the camera from her hands. She looked a bit shocked. I laughed and explained that it was a camera made from paper. She was curious and wanted to know more. I put the camera away until the end of the class but was encouraged that one of the students seemed excited at the prospect of using the camera.

After we finished a science lesson about how contaminants can enter into our food sources, we discussed where we might see contaminated water in Mesolandia. Then students made two teams, Sheryn was with another student, and Jaime and Cristina were partners. I showed the students how to use the disposable camera by taking a picture of each group with the camera they would be using. Students had twenty minutes to take 26 pictures of contamination in their community. To incentivize them to take pictures of contamination we devised a point system. Each team would earn one point for a clear picture of contamination, two points if they were in the picture to help demonstrate the contamination and they lost a point if the picture was inconclusive or of something unrelated.

I was very explicit that they would lose points if they took longer than the time allotted. I made this clear because I had walked around Mesolandia with my students before and knew it was difficult to get them to walk quickly. In Barranquilla and in Mesolandia in general, people do not move very fast. It is hot and if one walk fast one begins to sweat very quickly. Therefore, unless you are exercising, dancing, or planning to be sweaty, you walk slowly and try to take a route that allows you to stay in the shade. Students who participate in the after school program go to class in the morning and then eat lunch at home, take a shower or bath of some sort, and then come to class. Usually when we walk around the community, I have to ask them to walk a bit faster because otherwise we run out of time to complete whatever activity we are conducting. I have never seen the students move faster than a slow walk. However, when I said, "ready, GO," they took off at a slow trot.

I had not seen this amount of excitement about any previous group activity. When they returned, a little sweaty, they were excited about the pictures and wanted to know when they would get to see them. This was the first indication that the use of cameras and digital media technologies would benefit student learning and engagements.

I used the digital cameras twice more throughout the semester. Once for a weeklong assignment and another time to document the community meeting the students wanted to hold over their vacation in December (2010) when we did not meet. Students used the pictures they took in these activities throughout the semester. Their reflections on the use of the photos they took are most evident when they talk about turning pictures into YouTube videos. I discuss the analysis of these statements in the YouTube and Facebook section of this chapter.

Posters

As a social justice component to a lesson following the disposable camera activity I asked students to look at the pictures they took, choose the two that best demonstrated what pollution looked like in Mesolandia, and write a caption to the pictures they chose. Then, I asked them to think about what they had learned in the class, what they had documented with the cameras, and how they wanted to share that with the community in a phrase or sentence short enough to put on a poster. The students wrote messages about keeping Mesolandia beautiful, how contamination affects their health and offered solutions on how to fix the problems (See Figure 6).

Jaime wrote, "Take care of our neighborhood and don't throw trash in front of our houses. It is dangerous." He chose a picture of a dead tree next to a body of water. Jorge wrote, "Take care of our ecosystems. Don't send trash and contaminating products

into the pipes." Cristina message was, "take care of our environment for the health of the children!" and Sheryn wrote, "When we contaminate our water, we contaminate ourselves." These messages, and the messages they wrote on their second posters, demonstrated two general themes. First, visible trash on the ground makes our barrio look bad. Second, things we can't see in the water can poison us and be bad for our health and the health of children.

I had the posters laminated. In the following week, students were given the posters and asked them to hang them throughout the community. This was their first chance to communicate with an audience outside of the group. In Figure 6, two of the pictures of the posters before they were hung. The picture furthest to the left was taken of a poster hanging in the community more than a month after completing this exercise. One of the students pointed it out to me as we were walking to the river to do our water testing experiment.

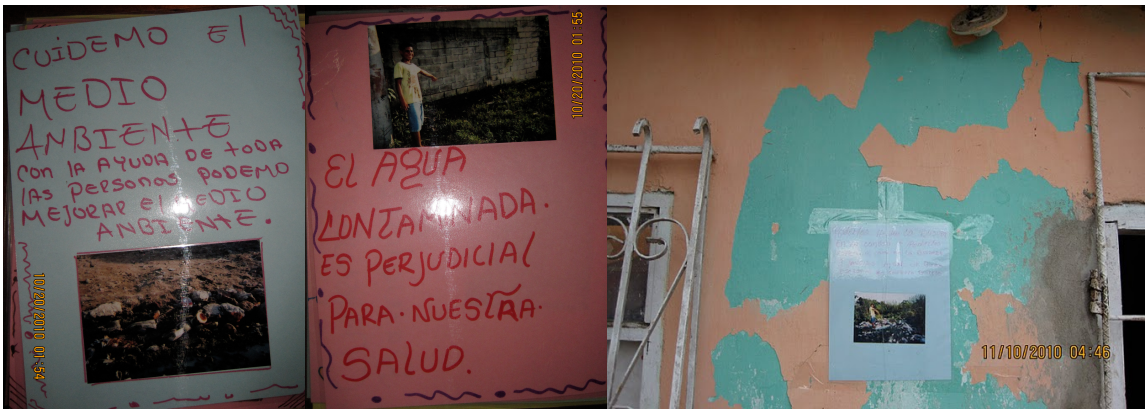

Figure 7: Student made posters

YouTube and Facebook

Students in Mesolandia have access to one Internet café in the community. In the four by ten-foot room, there are approximately four personal computers with outdated software and slow

Internet connections. The new school has computers but I have not seen them or been into the room where they are stored. As of March 2011, the computers had not been set up for student use. There is another Internet café a ten-minute walk from Mesolandia that has approximately eight computers with better software and faster Internet connections. The price to use the Internet is around 500 pesos (0.25 cents) for half an hour. This it is almost half the price of a one-way bus fair. Although their access to Internet and computers is limited, more than half of the students have e-mail accounts that they check about once a week (according to Cristina and Wendy). All of the participants in this study have told me they have Facebook accounts but I have only their verbal confirmation of this fact. Because of students' limited access to technology that would allow them to create YouTube videos, I invited the students to what they refer to as "*el Parrish*" to use school owned computers.

In early November 2010, the students came to Parrish to create their videos. They were to use the pictures they had taken in the first digital camera activity and use them to make a one-minute video. Then, the students wrote a script that they synchronized with music and used as a voiceover for the photographs. This activity intended to increase interest in the project and allow students an opportunity to share what they had learned with a larger audience.

Students arrived at the school at three in the afternoon and I brought them to my classroom. They were excited to use the computers, eat pizza, and use the school's gym and pool after we completed our project. In interviews with Cristina, Jaime, and Jorge conducted two weeks later, they recalled the experience. The following transcriptions indicate that students' interest in the subject matter increased when they had the opportunity to share what they learned with a larger audience. The use of digital media as a learning tool for science

(technology) and social justice objectives was partially responsible for the students' increased interest in the project.

Another indication that the video project increased student interest in the subject matter was evident in their end of the year reflection in which students reiterated that they hoped to use digital media again. Maria Fernanda wrote, "we should make the classes longer and go to Parrish five times a month! I want to make more videos about Mesolandia." Maria Fernanda demonstrated that she enjoyed making the video but also that she felt making a video specifically about her community was important to her. Jaime hoped that in the coming months to "make the group bigger, spend more time on our videos and presentations, and get the companies to stop polluting the water. I also hope that our English classes can continue." Jamie demonstrates here that he has made a connection between sharing his pictures and voice in the form of a video with getting the companies near the community to stop polluting.

Not only did students demonstrate an increased interest in the group's goal of sharing what they had learned about the environment with a larger audience, but they also demonstrated what they had learned about contamination and publically voiced how they would like to see their community change. Jorge wrote the following script for his video.

> These pictures show the reality of our society and you might be surprised to know we have to deal with chemicals like *acido cromo*. Already companies near our homes pollute the air and water in our environment with toxic chemicals while making their products. This puts us in danger, directly and indirectly, but the companies don't know that what they are doing is bad for the environment and it is terrible to live beside them. How can we get these companies to stop contaminating the environment and the people who live near their plants? Don't

> use so many chemicals in the products and stop sending toxic gases into the air so that we can breath better air!

Although it is not clear what he means that he has to "deal with chemicals like acido cromo," he understands that industrial contaminants, including chemicals, can contaminate water. He also recognizes that poor environmental conditions can lead to a lesser quality of life and poor health. He even goes so far as to offer a solution to the problem. This script demonstrates that Jorge's knowledge level about the environment increased from September 2010 to November 2010 due to his participation in the after school program. Additionally, he demonstrated that he was beginning to understand the connection between one's immediate environment and how that contributes to one's health and quality of life. Jaime demonstrated similar understandings in his video script. He writes:

> With our inventions, we are producing toxic waste and contaminating the water, an essential life component. Due to contamination, we are damaging our atmosphere and causing global warming. We all need to collaborate in order to save our planet.

Jaime demonstrates an increase in science vocabulary. Although it is unclear if he really understands the concepts of "global warming" and "atmosphere," he shows that he understands a need for people to "collaborate" in order to improve and protect water. Jaime calls water an "essential life component" which indicates an increased understanding of how water is related to health and quality of life. Cristina and Sheryn made a more direct connection between one's environment and quality of life when they wrote the following script:

> Environmental contaminants are polluting our atmosphere and uninformed people still throw their trash into the street and contributing to the contamination that causes our families and friends to get sick, especially in Mesolandia. Standing water that is contaminated becomes home to insects and mosquitos that cause sickness like dengue.

Cristina and Sheryn also showed an increased understanding of the causes that contribute to the contamination in their neighborhood and how that contributes to the health of community members. They also make a connection between standing water and an increase in disease carrying mosquitos. Cristina and Sheryn make an error in contributing contaminated standing water to the cause of these diseases rather than any standing water. However, it is clear they understand that living near (or in) a contaminated environment can put one at a higher risk for contracting diseases. Finally, Maria Fernanda had the following to share:

> If everyone did his or her part, we could make Mesolandia a better neighborhood by reducing the contamination. We can do it with the help of all of you. We can make a better neighborhood and a better future for ourselves. No more contamination!

Maria Fernanda spoke to her audience more directly than the other students did. She demonstrated here that she has embraced the idea that she can take what she learned in class and contribute to a discourse that can benefit her community. She told her audience "we can do it with the help of all of you!" Maria Fernanda also demonstrated an understanding that a reduction in contamination in the neighborhood contributes to an improved quality of life. Each of these videos allowed the students an opportunity to

synthesize what they had learned previous after school program meetings into a message to share with three audiences: the people in the room, potential YouTube viewers, and their Facebook friends.

After the students finished their videos we ate pizza and watched the video as a group. The audience consisted of eight students from Mesolandia, including the five discussed in this study, as well as two of students and five teachers who study and teach at the school where I work. I asked these students and teachers to help with this project because of their knowledge of technology and ability to use Windows Media Player. The two students I invited to help speak Spanish and two teachers had limited Spanish fluency. The three other teachers have very limited conversational Spanish. Nonetheless, this was the students from Mesolandia first audience on which to practice and share what they had learned in the after school program. As we made and watched the videos it appeared that everyone was engaged in the project. After the students left for the day several of the teachers made financial contributions to the group to support the project and two of the teachers showed in interest in becoming involved in the group on a more regular basis. I wrote about this in my journal as a first social justice victory for the group. On November 17, 2010 I wrote:

> We made the videos, the students had a great time, and we unexpectedly made 120,000 pesos to bring the students to Parrish again. I think they really made an impact on the others teachers. Part of social justice is making money for your cause or project and it is an important part of our project if we are going to continue to bring them to Parrish once a month to use the computers. This was also the students' first opportunity to show their pictures to people who are not

> from Mesolandia. It is shocking to see what kind of poverty they live in everyday and I think seeing the images and meeting them impacted the teachers. It seemed like the students new they were making an impact and felt proud and empowered. As their teacher, I certainly do!

I wrote this entry from the teacher perspective rather than from the perspective of a researcher. I was excited and felt like the students were demonstrating new science knowledge and becoming more confident in their ability to improve their community and quality of life. I believed that their first experience with an outside audience had been positive and that they would be able to use the skills they learned on the computers to better prepare for their April presentation at the Values Forum.

In addition to the group of people in the room, their second audience was strangers who might view their videos on YouTube. Although having an online audience can be very abstract the students felt like they were producing work that could be viewed by a global audience. As their teacher, I also encouraged this kind of thinking. In the prompt for their scripts, I asked them to think about what they would want to share with other students from around the world.

The people in the room and YouTube viewers were both audiences I planned for the students to consider. However, after the videos were finished and published to YouTube, the students from Mesolandia began signing onto their Facebook accounts to post the videos to their profiles. Their Facebook friends became their unexpected third audience of the day. When students posted their work on Facebook, they demonstrated full ownership of the project and were proud to post it in a public forum. Their excitement, pride and wiliness to share ideas indicated an important relationship between

the incorporation of media sharing and social networking in social justice education and learning. Using tools like Facebook and YouTube helped students develop shared ownership of the project based on their perceptions of truth and their social knowledge base. When the students had the opportunity to create a YouTube video by putting their words and voice over a slide show of the pictures they took in the community, they felt proud of their product, motivated to continue their work, and empowered to make a difference in their community.

The Values Forum

In preparation for, during, and in the weeks after the students' final presentation at the citywide values forum, they further demonstrated how their attitudes about science learning and perceptions about their ability to improve their immediate environment changed over the period of this study. To help students explore possible topics they wanted to include in their presentation video and PowerPoint, I asked students to write and record stories about how contamination in Mesolandia affected their lives. In these audio recordings, students' connected contamination in the community to their health and quality of life. In one recording, Cristina discussed how standing water in the community increases the likelihood of dengue fever and how this is especially dangerous for children living in Mesolandia. She recorded the following:

> One big problem we have in Mesolandia is the standing water. This causes many illnesses and one of them is dengue. This really affects the kids and causes diarrhea, vomiting and fever. It is a big problem in the community.

Cristina very directly associated an environmental issue with a health issue. This is a demonstration of how she connected her experiential knowledge base with what she learned in the after school program. Sheryn and Maria Fernanda adapted this assignment

to better fit their comfort levels by conducting mock interviews with one another. They also discussed heath issues that are caused by the contamination in the community.

Sheryn: What types of illnesses does the standing water cause?

Maria Fernanda: It causes diarrhea, skin infections, vomiting… many, it causes many.

Sheryn: The water that you throw out (of the houses), where does it go?

Maria Fernanda: Well, there is no sewer system so we have shallow ditches in the middle of the streets that lead to the Laguna (standing water next to the river)

In this mock interview, Sheryn and Maria Fernanda are attempting to teach their audience how lack of improved sanitation contributes to health problems. In another section of their interview, they discuss their right to water and the theme of the values forum. The theme of the forum was, "*Ser differentes nos hace iguales*" which can be translated in multiple ways. A direct translation is, to be different makes us equal. Sheryn and Maria Fernanda discussed how they interpreted the theme in the following section of the interview:

Sheryn: The theme of the values forum is, we are all different but quality. What does this mean to you?

Maria Fernanda: This means we all have the same rights and the same obligations. But in the case of Mesolandia, it does not feel like we have the same rights because we are having problems getting water.

Sheryn: What problems are you having with the water?

Maria Fernanda: Well, some families have note been able to pay the water bill but it is unfair to pay because the water only comes three hours a day (if at all). This is not enough time to get the amount of water we need because at first it comes out dirty and smells terrible.

Sheryn: After, do you have to throw out the dirty water?

Maria Fernanda: Of course, because it smells terrible and it is not usable. It comes out black.

Sheryn: What do you have to do to drink this water?

Maria Fernanda: Well, we have to wait until it stops coming out of the tap stinking. Then we can fill a tank and drink the water.

Maria Fernanda and Sheryn believe that they have a right to clean drinking water but do not feel like this right is being honored because the quality of the water is poor and water availability is unpredictable. In another recording, Sheryn talked about the domestic contamination in the city. She discussed the reasons for this contamination and one's personal responsibility to improve the situation. She explains:

You can see contamination in all the barrios of the south (of Barranquilla) because people throw paper and plastic bags in the streets in front of their houses. They are not conscientious of the harm they are causing. All of us who do this, and this includes me, are hurting the planet (when we throw trash on the ground).

Sheryn's statement about how she was contributing to the contamination issues in the community is one that several students made in interviews and conversations in February and March 2011. In a group interview, Jaime and Jorge both discussed how

after their participation in the project, they stopped throwing trash on the ground and encourage their friends to do the same.

In the weeks leading up to the April 2011 values forum, students' demonstrated an increased knowledge of environmental science and an awareness of how a contaminated environment affects their health. They also accepted responsibility for contributing to the problem in the past but changed their behavior after working with the after school program.

The final presentation at the values forum was a public presentation of everything they learned over the course of the study. In this space, participants demonstrated their knowledge of environmental science, their improved confidence in public speaking, and an increased awareness that speaking to an audience outside of Mesolandia was important in accomplishing their social justice goals. The students prepared a video and PowerPoint that they shared in a twenty-minute presentation. They also passed out the pictures taken throughout the nine months. Each audience member received two to three photographs of contamination in Mesolandia.

After the students presented there was a five-minute question and answer session. Students in the audience asked just a few questions before the discussion was ended due to time limitations. After the presentation, several students from Parrish asked me how they could help. One student suggested a bake sale to raise money, another suggested getting in contact with a local organization dedicated to exposing companies that pollute. I encouraged them to share these ideas with the students from Mesolandia.

One of the Parrish students who is interested in studying environmental law asked Sheryn if she could come to Mesolandia the following Monday. Sheryn said that she would give her a tour of the neighborhood and the young women began making plans. In the following meeting, the five participants in this study, three students from Parrish, and six of the new tenth grade students created committees based on their interests and began brainstorming solutions.

By presenting at the forum students from Mesolandia were able to evoke compassion and interest from a group of students who, before their presentation, did not know about the conditions in Mesloandia. Jaime said to me after this meeting, "we did a good job." He recognized that involving students from outside the community was an important social justice accomplishment. In discussions with the students from Mesolandia and Parrish, both groups of students made it very clear that the digital media that was shared in the values forum made the presentation much more powerful. Based on informal discussions, I believe that the response from the Parrish students resulted from them being able to "see" the problem rather than just hearing about the problem. The students from Mesolandia felt the same. They believe that the use of digital media in their presentation was the main reason it evoked a strong audience response.

Trust, Long Term Engagement and Reciprocity

In addition to changes in students' attitudes and perceptions about the environment after science and social justice lesson, another theme became apparent during data analysis. First, that as students began to trust me, they began to share more openly about environmental challenges they faced in their daily lives and demonstrated an increased interest in the long-term goals of the project. Students also provided strong feedback that the trip to Parrish increased their level of

interest in the project. In the following section I demonstrate how long term engagement and researcher/participant reciprocity played a significant role in how students choose to engage in project goals.

"Why are kids in Africa so malnourished?" Sheryn asked me during our first conversation of the semester. It was early September (2010), the rainy season on the coast of Colombia. It was our first meeting without Becky and we had not seen each other in three months. Jaime, Jorge, Cristina and Sheryn were the only students at the first meeting. I did not meet Maria Fernanda for another month. Because the school was under construction we met on the patio near the front gate. There we were, an *extrajera* and four unsure students sitting in rusted old fashion desks while the security guard and several construction workers mulled around us, occasionally interjecting a "When you teach me ingles?" or an "Oh my god."

Sheryn posed her question in an awkward icebreaker game I thought might get us talking about environmental issues in Colombia and water quality issues in Mesolandia. I designed the game as a kind of diagnostic test to find out if the students were interested in learning about the environment. Did they think water quality was an issue in Mesolandia?

There was little evidence of this based on the questionnaire administered during the first meeting.

When Sheryn posed this question to the group, I asked her what made her think to ask about children in Africa. She said that it was sad that kids did not have enough food. Ironically, at that moment we were sitting next to a mango tree that these students eat from when the fruit is in season. During this conversation, the students made no comparison between themselves and children living in poverty in other parts of the world. It was strange to me that these children, living in one of the poorest neighborhoods in Barranquilla, would feel sorry for children in

another part of the world who did not have enough food rather than sharing feelings of solidarity with them. There could have been multiple reasons for this. Toward the end of this study, in interviews and writings, the students began to identify Mesolandia as "*un barrio muy pobre,*" a very poor neighborhood. I believe now that they chose not to talk about their neighborhood's socioeconomic status in our first meetings because we had not established trusting relationships. During the course of the study, I found that two factors greatly contributed to progress students made in the science and social justice components of the curriculum. First, long term engagement in the community allowed students to build a trusting relationship with me that could not have existed in a short term project due to my outsider status. Second, students had to trust each other and we had to establish a safe learning environment before students felt comfortable talking about difficult and personal topics. What I found as the semester progressed was that students' willingness to talk about difficult topics like poverty, living in flooded homes, lack of access to improved sanitation and attending school in crowded facilities depended on how safe they felt in group meetings, with me, and with other visiting teachers. This correlation is important when considering how knowledge acquisition effects behavioral changes.

The importance of trusting relationships and safe learning spaces was evident when I began to use team-building activities to help build intergroup relationships and create a safer learning space for students. Just as communication between teacher and student is important, making communication between students a valuable and safe transaction is critical to the success of any program, in particular in spaces outside of a traditional classroom with structured discipline systems. In these spaces, students choose to behave because they want to, not because they have to.

Just as I recognized that students did not yet trust me during our first meeting, I saw that they did not trust each other in learning spaces during our third meeting. On that particular day, I passed out papers for students to share between two small groups. There were enough pages for the students to have one in front of them that they were to study, summarize and teach to their group members before passing the paper to the other group. In my classroom, this modified jigsaw method of cooperative learning works well. However, within a few minutes some of the students had decided they did not like the page I gave them, and were tearing pages out of the hands of other students. I had also passed out the daily snack a little early so they could eat and work on their projects. This also turned into a grabbing match. In addition, we were working in a hot, dusty classroom that smelled of paint and there were not enough chairs for everyone. Some of the students were standing or perching on the side of the table. Not only were we working in a poor physical space, but we were also in danger of creating an unsafe learning space.

I have always prided myself on how I am able to manage a classroom. It is one of my strengths as a teacher. However, this behavior was far from what I was used to from Parrish students who saw me as an authority. I knew that if I let this type of digression happen again that I would be hard pressed to accomplish anything with the students, but I also felt sure that my typical methods would not work as well in this setting.

During the next week, I approached several teachers at my school with experience in nontraditional educational settings (summer camps and youth groups) and gathered ideas for team building and trust building activities. I decided to begin the following session with an activity that would make the class more fun, build trust between the students and to try to create a safer learning space. During our fourth meeting, I asked the students to move the table we use

outside and we gathered enough seats for everyone. I also made sure that the seats formed a well-spaced circle where each person could look directly at the other people in the group. Then, before sitting down to begin the lesson we did two team-building activities.

In the first activity I asked the students to line up against a wall, shoulder to shoulder, hook arms with the person next to them and place the side of each of their feet parallel and touching their neighbors foot. In this human chain they had to coordinate their walking to cross the room in a manner that allowed their arms to stay hooked and their feet to stay touching. If they came "undone," they had to return to the wall and begin again. The students were smiling and laughing as they figured out the best way to coordinate their walking. They all were yelling at first before deciding on a better method of communication where only one person gave the directions. They made it to the other wall in about five tries. The second activity, Earth Eyes, had the students and I stand in a circle and look at the ground. When I said "*ojos*," they had to look up at another person in the group. If two people made eye contact, they were "out." Whenever they would make eye contact with another person, they would laugh and smile.

The students were smiling and energized as we began the lesson. This energy translated into productive learning time and better communication within the group. For the remainder of the semester we began each lesson with a short team building exercise that set the tone for the rest of the day. I learned that regardless of where one teaches, taking the time to make that space physically and emotionally safe for learning is very important.

By the end of the semester, the students' trust in me as their professor and in each other is evident in their writing. In our last meeting in December 2010, Maria Fernanda wrote:

> I like that we are all friend here and that the professors are patient, friendly, love us and above all show us respect. I like that our group has confidence and that we get to visit Parrish and make videos.

Maria Fernanda understands her trip to Parrish as part of a reciprocal and respectful relationship between the students and the professors (me and other teachers I invited to work with the group). She also believes that the "group has confidence," signaling that she feels like a respected member of the group and believes that the group is a safe space to learn. Jaime echoed Maria Fernanda's sentiments when he wrote:

> I really like that we get to make videos about the environment. I like that the professors are nice and that I have made new friends in the group. I am excited to go to Parrish for the Values Forum and I enjoy learning English each week.

Cristina also felt like the trip to Parrish was a reward for working hard during group time. In order to be invited on the Parrish trip, students have to have good attendance. I interpreted her response as recognizing reciprocity in our relationship when she wrote:

> I really like that we have good friendships in the group and that we can trust the professors and that they are nice to us. I enjoy making the videos. I would like to continue the classes and visit Parrish again. Maybe we could meet more often.

Finally, Jorge wrote that he enjoyed learning with the group. This signals that he feels like the culture of the group is conducive to learning and that he feels like a valued member of the community. He wrote:

> I like the professors because they are nice to us. I like that we always do work in our meetings and that everyone contributes something to the class. I learned how water is contaminated and how to make a video.

These examples of how students showed that they trusted each other and me was crucial and intertwined with any change I observed in students' attitudes and perceptions about their ability to improve their living conditions. Throughout the study, how students' feelings about me and other students in the group, as well as the space we were working in, were crucial to any progress they demonstrated in mastering learning objectives.

The literature supports these conclusions from both those who argue that environmental education contributes to behavior change and those who argue that it does not. For example, in an article dedicated to environmental education Cockerill (2010) writes about a Community Water Education Program. I was hoping to find an article that supported my work and helped me better understand how to develop this program. What I found instead was what I continued to find in many journals. Cockerill's (2010) education projects consisted of holding 14 twenty-minute meetings about water availability and management. In the concussion, Cockerill (2010) makes the following assertion:

> Keeping the formal presentation focused on information rather than advocacy allowed attendees to explore their own ideas about action and to clarify the relationships among potential actions and the physical reality of water processes. These conversations form the basis from which these communities can generate an even stronger understanding of water and potentially move that understanding toward action of their own design. Experience in collaborative processes shows that when people engage in discussion among themselves and with technical experts to better understand a complex issue, they become vested in the process

> and that can translate into changed attitudes and more informed decision making (p. 162).

I agree with Cockerill's claim that the generation of ideas developed for and by community members can often produce welcome and lasting change. These ideas are concurrent with critical social theory. However, I do not believe that a change in attitude can happen in a twenty-minute session on water science. Sessions like this can be informative and can excite people but is there really a lasting effect in water education programs designed similarly to this one?

A sustained engagement with a community is more powerful (potentially in both positive and negative ways) than short-term engagement like that described in Cockerill's study. I used the analogy; volunteerism is to community engagement as short-term projects are to extended fieldwork, to describe the relationship between long-term engagement and trusting relationships between researcher and participants. Short-term projects can have a positive effect on a community, but one town meeting is similar to volunteering once at a soup kitchen. One never knows the people you are feeding and there is not time for exchanges of information, ideas and culture that are so important in the process of challenging ideas of truth and reality. In contrast, I believe long-term engagement as a researcher is like long-term community engagement by volunteers. The length of the project contributes to progress students made in learning and leadership development.

Chapter 5: Conclusions

The data accumulated for this study in the form of field notes, archival data, and interviews suggest that science learning took place and that students' interest in learning about science increased significantly. Participants' confidence in their ability to make positive changed in the their community and their ability to define those problems and offer solutions also increased. These positive results depended on three major factors: a multifaceted curriculum that combined science learning with local social justice issues, the use of digital media and technology as a teaching tool and an investment incentive, and a long-term engagement in the community by the researcher. All of these factors served important roles in the outcome of the project.

Jorge and Maria Fernanda reinforced these findings during our meeting the second day back in February 2011, after my Christmas break and their summer break. On this day, newly promoted tenth grade students began attending meetings. Because they had just begun their new academic year, the principal invited the students to the meeting for the first time. I had not anticipated acquiring new students on this day and had instead planned a parent meeting to discuss the upcoming visits to Parrish and the April values forum at which the students were to present. I arrived early, met four of the new students, and waited for the veterans and their parents to arrive. Fifteen minutes later, Jorge, Jaime and Cristina walked in with their mothers. We sat down and began to discuss plans for the semester. Because I had to change our meeting day to Monday due to my class schedule, we have had to work around the many Monday holidays.

It was a slow start to the semester. I had been calling the poor principal in Mesolandia constantly. "Can we meet today?" I would ask. She responded, "no, the students are still on

vacation" or "no, the water connection at the school has been turned off and we have already canceled classes and sent the students home." Finally, I stopped asking and said, "I am coming today, and I am so excited to see you and the students!" She told me she would be there waiting for me. I left school early to get there before she left but she was long gone by the time I arrived. I felt we were losing the momentum that was so palpable at the end of November and now, new students meant we were starting from scratch.

At a transition point in the meeting, I turned to the veterans in the group and asked, "So, can you tell these new guys what we have been learning?" and give them a reassuring smile. I was ready to prompt them more but Jorge surprised me once again. He looked up and concisely explained to the new students what they should expect to learn in our meetings. "We learn about how the environment becomes contaminated and what we can do to make it better. We make videos about Mesolandia and put them on the Internet. Two types that concern us, industrial contamination and…" "Domestic and urban!" Maria Fernanda chimed in. I felt a wave of relief sweep over me. They had not forgotten what we learned.

Maybe I should not have been so relieved. The ground in Mesolandia is still covered with trash, no municipal sewer lines have been installed in community homes, the new school still has no water service, and the industries near the community have not been confronted about their contributions to contamination. The reality is that cleaning up Mesolandia to standards set by the United Nations (2010) Millennium Goals would take more time and more resources than this graduate student could generate in the time frame of this project. Nonetheless, the goal of the project was to influence student's attitudes and perceptions about their ability to make positive environmental changes in their community. Although Mesolandia may look the same, the data indicate that these five students demonstrated positive changes in their attitudes and

perceptions about their environment. They also showed an increase in their level of confidence in sharing that knowledge with their community.

Using a curriculum based in Barton's critical feminist approach to teaching science and social justice, I was able to use digital media as a tool in a long-term after-school program to teach students about how environmental science is connected to their health and quality of life. I took a woman centered approach to writing a critical feminist ethnography that documents how students explored issues knowledge and power in the context of contamination problems in their community. This approach allowed students to learn science in a way that valued their way of knowing the world and their experiential knowledge. I found that when science teaching was focused on experiential knowledge and connected to social justice, students were more likely to embrace science knowledge as a tool for fighting against oppression. Additionally, the use of digital media as a teaching tool and learning incentive in programs such as this one is becoming increasingly important. The way in which people share information and organize for social change is evolving as technology changes and becomes more available. Critical research must keep up. Finally, programs that aim to create behavioral changes, especially in terms of behaviors related to conservation and sustainable lifestyles, are far more effective when they are taught in a long-term curriculum rather than in single lessons or short-term projects.

In July 2010, just months before beginning this thesis, the United Nations declared that "safe and clean drinking water and sanitation is a human right essential to the full enjoyment of life and all other human rights" (UN News Service, 2010, p. 1). The young leaders of Mesolandia must know this, embrace this, and use this declaration to lead their community. This project was a first step in accomplishing local goals that represent an issue of global importance.

Notes

[1] I have chosen to use "Developing Country" to describe Colombia because it seems like an appropriate descriptor. If 'developing' were interpreted as "becoming more like the U.S" I would argue that many of the changes happening in Colombia, from fashion and supermarkets to military drills and legislation, are based on influences of American pop culture and the strong alliance between the governments of the U.S and Colombia. If "developing" were interpreted as "changing rapidly" I would argue that this is true of Colombia too. For example, all of Colombia's large cities are investing in modern public transportation systems, the civil war that has ravaged much of the county appears to be coming to an end, international truism is increasing dramatically. Because of this, I choose to describe Colombia as Developing rather than Third World.

[2] Central Intelligence Agency (2011) of the United States reports on Colombia's recent political history: A four-decade long conflict between government forces and anti-government insurgent groups, principally the Revolutionary Armed Forces of Colombia (FARC) heavily funded by the drug trade, escalated during the 1990s. The insurgents lack the military or popular support necessary to overthrow the government and violence has been decreasing since about 2002, but insurgents continue attacks against civilians and large areas of the countryside are under guerrilla influence or are contested by security forces. More than 31,000 former paramilitaries had demobilized by the end of 2006 and the United Self Defense Forces of Colombia (AUC) as a formal organization had ceased to function. In the wake of the paramilitary demobilization, emerging criminal groups arose, whose members include some former paramilitaries. The Colombian Government has stepped up efforts to reassert government control throughout the country, and now has a presence in every one of its administrative departments. However, neighboring countries worry about the violence spilling over their borders. In January 2011, Colombia assumed a nonpermanent seat on the UN Security Council for the 2011-12 term (p. 1).

[3] A community can be local or global. The community student participants interacted with in this study included their immediate community, their larger peer community in Barranquilla, and a global community of YouTube users.

[4] All participant and nonparticipant names of minors have been changed.

[5] The World Health Organization (WHO) and United Nations Children's Fund's (UNICEF) Joint Monitoring Programme for Water Supply and Sanitation define the quality of a communities access to water sanitation practices using a ladder metaphor (see Figure 7).

[6] A compellation of the YouTube videos made by students can be found at http://www.youtube.com/watch?v=ih9oKCgAczk and the English version of the students' final video used in their presentation at the values forum at http://www.youtube.com/watch?v=uw-AGn6WX1s

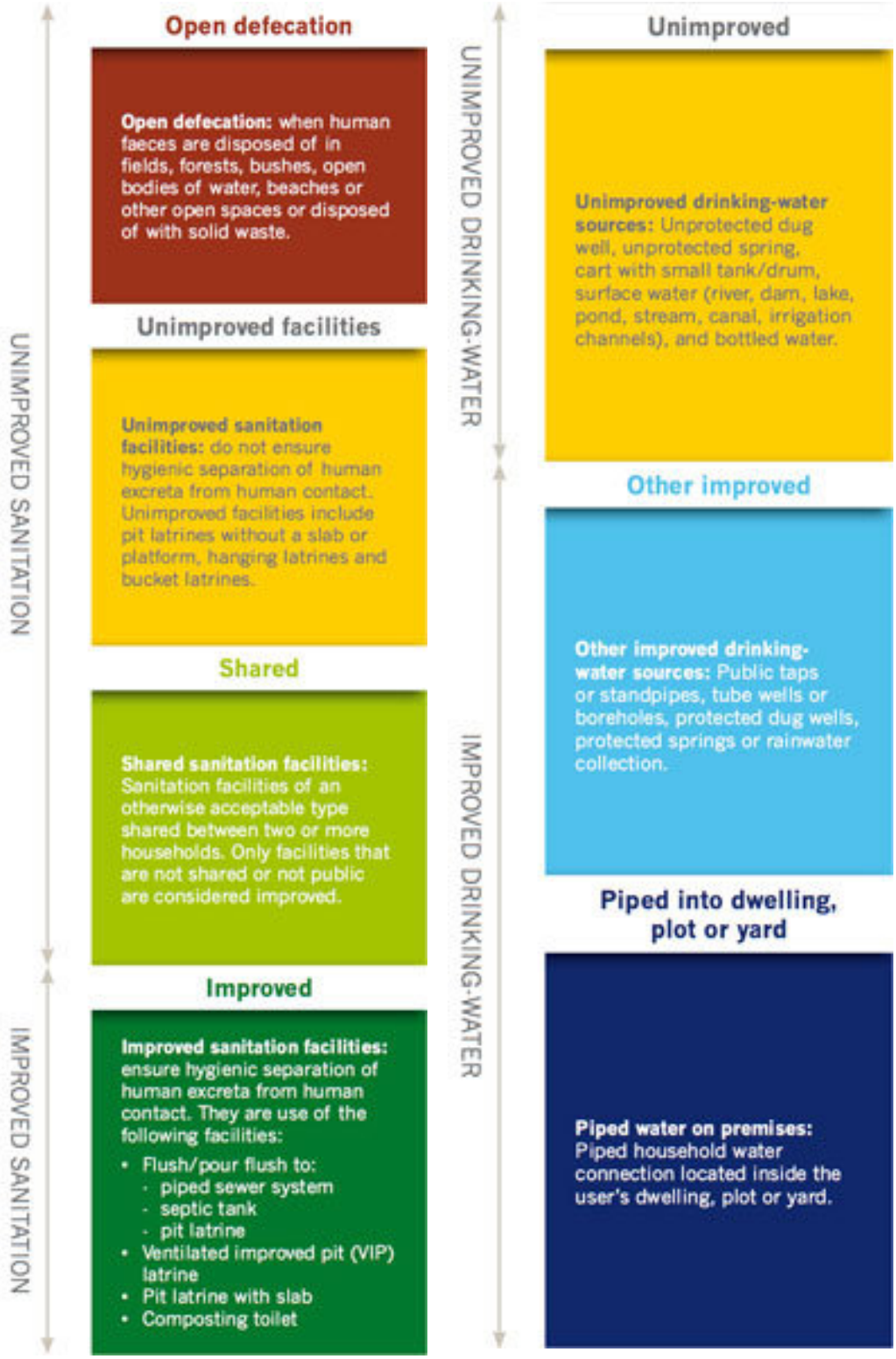

Figure 8: Sanitation and Water Ladders

References

Barton, A.C. (n.d.). Angela Calabrese Barton. Retrieved from http://education.msu.edu/search/Formview.aspx?email=acb@msu.edu

Barton, A.C. (1998a). *Feminist Science Education*. New York: Teachers College Press.

Barton, A.C. (1998b). Teaching science with homeless children: Pedagocy, representation, and identity. *Journal of Research in Science Teaching, 35*(4), 379-394.

Barton, A.C. (2002). Science education for empowerment and social change: A case study of a teacher educator in urban Pakistan. *International Journal of Science Education, 24*(9), 899-917.

Barton, A.C. (2006). Capturing urban student voices in the creation of a science mini-documentary. *Journal of Research in Science Teaching, 43*(7), 667-694.

Barton, A.C. (2010). "It changed our lives": Activism, science, and greening the community. *Canadian Journal of Science, Mathmatics and Technology, 10*(3), 207-222.

Central Intelligence Agency. (2010). *The world fact book: Colombia.* Retrieved from www.cia.gov

Cockerill, K. (2010). Communicating How Water Works: Results From a Community Water Education Program. *Journal of Environmental Education*, *41*(3), 151-164.

Conroy, R. M., Elmore-Meegan, M. Joyce, T., McGuigan, K.G. & Barnes, J. (1996). Solar disinfection of drinking water and diarrhea in Maasai children: A controlled field trial. *The Lancet 348*, 1695-7.

Denzin, N. & Lincoln, Y. (Eds.). *Handbook of Qualitative Research.* London: Sage Publications.

Gleick, P. H. (2009). *The world's water: The biennial report on freshwater resources.* Washington, DC: Island Press.

Gubrium, A. & Harper, K. (2009). Visualizing change: Participatory digital technologies in research and action. *Practicing Anthropology, 31*(4), 2-3.

Hoffmann, S. (2009). *Planet Water: Investing in the world's most valuable resource* [Kindle Edition]. Retrieved from Amazon.com

Holmstrom, D. 1999. For Nepal's women, hope flows with water. *Christian Science Monitor, 91*(11), 14.

Hoque, B., Mahmood, A., Quadiruzzaman, M., Khan, F., Ahmed, S., Shafique, S., Rahman, M., Morshed, G., Chowdhury, T., Rahman, M., Khan, F., Shahjahan, M., Begum, M. &Hoque, M. (2000). Recommendations for water supply in arsenic mitigation: a case study from Bangladesh. *Public Health (Nature)*, *114*(6), 488-494.

Internal Displacement Monitoring Centre (IDMC). (2009). *Colombia: New displacement continues, response still ineffective.* Retrieved from www.internal-displacement.org

Kemmis & McTaggart, (2000). Participatory action research. In Denzin, N. & Lincoln, Y. (Eds.). *Handbook of Qualitative Research.* (pp. 567-605). London: Sage Publications.

Kincheloe, J. & McLaren, P. (2000). Rethinking critical theory and qualitative research. In Denzin, N. & Lincoln, Y. (Eds.). *Handbook of Qualitative Research.* (pp. 279-313). London: Sage Publications.

Kingsolver, B. (2010) Fresh water. *National Geographic 217(*4), 36-59.

Kuan, T. & So, M. (2008). Environmental learning using a problem-based approach in the field: A case study in a Hong Kong school. *International Research in Geographical and Environmental Education, 17*(2), 93-113.

Lincoln and Guba (2000). Paradigmatic controversies, contradictions, and emerging confluences. In Denzin, N. & Lincoln, Y. (Eds.). *Handbook of Qualitative Research.* (pp. 163-188). London: Sage Publications.

Metwally, A. M., Saad, A., Ibrahim, N. A., Emam, H. M., & El-Etreby, L. A. (2007). Monitoring progress of the role of integration of environmental health education with water and sanitation services in changing community behaviors. *International Journal of Environmental Health Research, 17*(1), 61-74.

Mora, I. (2009, February 10). Estrato 1 de Barranquilla paga agua más cara que estrato 4 de otras ciudades, reveló estudio de Superservicios. Retrieved from portafolio.com.co

Pearce, F. (2007). *When the Rivers Run Dry: Water--The defining crisis of the twenty-first century* [Kindle Edition]. Retrieved from Amazon.com

Pillay, P. (2006). Human resource development and growth: improving access to and equity in the provision of education and health services in South Africa. *Development Southern Africa*, *23*(1), 63-83.

Preston, J. (2011, February 5). *Movement began with outrage and a Facebook page that gave it an outlet*. Retrieved from http://www.nytimes.com

Punto de Encuentro. (n.d.). In *Facebook* [Friend page]. Retrieved September 26, 2010, from http://www.facebook.com/home.php#!/group.php?gid=6146939402&ref=ts

Resources for the Future (RFF). (2010). *Environmental management in Colombia.* Retrieved from http://www.rff.org/rff/News/Features/Environmental-Management-in-Colombia.cfm

Rosenberg, T. (2010). The burden of thirst. *National Geographic 217*(4), 96-115.

Schwandt, T. (2007). *The SAGE dictionary of qualitative inquiry* (3rd ed.). Los Angeles, SAGE Publications.

Segerfeldt, F. (2005). *Water for Sale: How business and the market can resolve the world's water crisis* [Kindle Edition].

Tignino, M. (2007). Water, women and international law. *International Feminist Journal of Politics 9*(4), 524-526.

United Nations. (2010). *The Millennium Development Goals Report*. New York, New York: An Inter-Agency and Expert Group on MDG Indicators.

UN News Service. (2010, July 28). *General Assembly declares access to clean water and sanitation is a human right*. UN News Service. Retrieved from http://www.un.org/apps/news/story.asp?NewsID=35456&Cr=SANITATION

World Health Organization (WHO) & United Nations Children's Fund (UNICEF). (2010). *Joint monitoring programme for water supply and sanitation: Estimates for the use of improved sanitation facilities, Colombia*. Retrieved from wssinfo.org

Appendices

APPENDIX A

Internal Review Board Protocol

The TCU Institutional Review Board (IRB) is responsible for protecting the welfare and rights of the individuals who are participants of any research conducted by faculty, staff, or students at TCU. Approval by the IRB must be obtained prior to initiation of a project, whether conducted on-campus or off-campus. While student research is encouraged at both the undergraduate and graduate level, only TCU faculty or staff may serve as Principal Investigator and submit a protocol for review.

Please submit this protocol electronically to Dr. Morrison Wong, IRB Chair, Dr. Janis Morey, Director of Sponsored Research, and Barbara McGinnis. Also submit a consent document, HIPAA form if applicable, Protecting Human Research Participants Training certificates, recruitment materials, and any questionnaires or other documents to be utilized in data collection. A template for the consent document and HIPAA form, instructions on how to complete the consent, and a web link for the Protecting Human Research Participants Training are available on the TCU IRB webpage at www.research.tcu.edu. Submission deadline for protocols is the 15th of the month prior to the IRB Committee meeting.

1. **Date:** October 23, 2010

2. **Study Title:** Mediating Equity in Shared Water Between Community and Industry: The effects of an after school program that addresses adolescents' knowledge, attitudes, and perceptions of water science and environmental issues.

3. **Principal Investigator (must be a TCU faculty or staff):** Molly Weinburgh

4. **Department:** College of Education

5. **Other Investigators: List all faculty, staff, and students conducting the study including those not affiliated with TCU.**

   Chandler Patton

6. **Project Period:** December 2010 to December 2011

7. **Funding Agency:** n/a

8. **Amount Requested From Funding Agency:** n/a

9. **Due Date for Funding:** n/a

10. **Purpose:** Describe the objectives and hypotheses of the study and what you expect to learn or demonstrate:

The primary goal of this study is to provide a nuanced understanding of young adults' knowledge, attitudes, and perceptions of water science and environmental issues and how these change during an after school program focused on shared water between the community and industry. Because this is an exploratory study, no hypotheses can be stated.

11. **Background: Describe the theory or data supporting the objectives of the study and include a bibliography of key references as applicable.**

As a researcher in this community I have chosen to conduct a critical ethnography. Originally, participatory research evolved from traditional social research. "Weber defined sociology as a science concerned with the interpretative understanding of social action, and social action as a behavior meaningfully oriented toward the behavior of others" (as cited in Schwandt, 2007, p. 1). It is also "often associated with social transformation in the Third-World" and community development (Denzin & Lincoln, 2000, p. 568). Critical research involves social analysis that deconstructs power relationships in a community and the social situation of stakeholders. Goals of critical research include having shared ownership of a project, the analysis of social problems and the orientation toward community action in the form of social, economic and political development (Denzin & Lincoln, 2000).

During the course of this research I intend to use critical ethnography to investigate knowledge, attitudes and perceptions of water science and environmental issues in young adults in a highly disenfranchised community near Barranquilla Colombia. Schwandt (207) explains that critical ethnography integrates "theory and practice in such a way that individuals and groups become aware of the contradictions and distortions in their belief systems and social practices and are motivated to change those beliefs and practices" (p. 51). Denzin & Lincoln elaborate that critical ethnography does more than display the results of the inquiry process but will utilize research results in a way that "those under study will gain self-understanding and

self-direction" (p. 297). I will act in a participatory manner to understand how knowledge acquisition by members of an after school program group might translate into motivation, mobilization and awareness about water and sanitation within the immediate community.

Denzin, N. K., & Lincoln, Y.S. (2000). *Handbook of qualitative research* (2nd ed.). Los Angeles, Sage Publications, Inc.

Schwandt, T. (2007). *The SAGE dictionary of qualitative inquiry* (3rd ed.). Los Angeles, SAGE Publications.

12. <u>Subject Population:</u> Describe the characteristics of the participant population including the inclusion and exclusion criteria and the number of participants you plan to recruit:

Five to eight students, ages 16-18, will participate in this study. All students enrolled in the after school program sponsored by Punto de Encuentro will be included as possible participants. Only students not giving personal and parental (guardian) consent will be excluded from the research component.

13. <u>Recruitment Procedure:</u> Describe your recruitment strategies including how the potential participants will be approached and precautions that will be taken to minimize the possibility of undue influence or coercion. Include copies of the recruitment letters, leaflets, etc. in your submission.

Research participants are students currently enrolled in an after school program in a community Colombia. Student will be told about the research and be given the opportunity to participate. Students will be informed that participation in the study does not affect their ability to participate in the after school program.

14. <u>Consenting Procedure:</u> Describe the consenting procedure, whether participation is completely voluntary, whether the participants can withdraw at any time without penalty, the procedures for withdrawing, and whether an incentive (describe it) will be offered for participation. If students are used as participants, indicate an alternative in lieu of participation if course credit is provided for participation. If a vulnerable population is recruited, describe the measures that will be taken to obtain surrogate consent (e.g., cognitively impaired participants) or assent from minors and permission from parents of minors.

Students and their parents (guardian) will be presented with a written consent form in Spanish. Information about the study will also be presented to students and parents verbally due to the low literacy level within the community. Consent will be given verbally and recorded for each participant.

Participation is voluntary and a participant may withdraw at any time without penalty. Participants may withdraw by telling either Chandler Patton (researcher) at 3016363150 or in person.

15. **<u>Study Procedures:</u> Provide a chronological description of the procedures, tests, and interventions that will be implemented during the course of the study. Indicate the number of visits, length of each visit, and the time it would take to undergo the various tests, procedures, and interventions. If blood or tissue is to be collected, indicate exactly how much in simple terms. Flow diagrams may be used to clarify complex projects.**

The project period will be from December 2010 to December 2011 pending the approval of the IRB. Each week I will visit Mesolandia for two hours during the normal after school program. Each consenting student participant will also take part in two 30-minute interviews during the study. These interviews will take place after youth group or during the day on the weekend. The time and location will be agreed upon by student and researcher. Before interviews take place I will meet with each student's parents and read to them the content of the consent form and media release form. If parents consent that an interview can take place, their consent will be recorded verbally with a digital voice recorder. Beyond the regular amount of time for the after school meeting, participants will give 1 hour of time to the study for these interviews.

16. **<u>Data Analyses:</u> Describe how you will analyze your data to answer the study question.**

Interviews will be transcribed from audio-recordings and notes, fieldnotes will be taken during observations and expanded, and archival items artifacts collected and catalogued in preparation for data analyses. Data analyses will entail the more traditional forms of qualitative inquiry using content analysis and coding. Data will be organize into units for analysis (unitizing); categorizing data units (coding, categorizing, piles); and developing theoretical implications and research findings.

17. **<u>Potential Risks and Precautions to Reduce Risk:</u> Indicate any physical, psychological, social, or privacy risk which the subject may incur. <u>Risk(s) must be specified</u>. Also describe what measures have been or will be taken to prevent and minimize each of the risks identified. If any deception is to be used, describe it in detail and the plans for debriefing.**

Physical, psychological, and emotional risks are minimal in this study and not greater than risks associated with daily activities and participation in the after school program. Some risk may include concern over having work, prepared during the after school activites, examined by the researcher. Additional risk might include peer teasing for agreeing to be interviewed. Procedures to minimize the social risk have been established. Of most concern would be a breach in confidentiality. Additionally, research participants may withdraw from the study at any time. No deception is used during this study.

18. <u>Procedures to Maintain Confidentiality:</u> Describe how the data will be collected, de-identified, stored, used, and disposed to protect confidentiality. If protected health information is to be re-identified at a later date, describe the procedure for doing so. All signed consents and hard data must be stored for a minimum of 3 years in a locked filing cabinet (and locked room) in the principal investigator's office, lab, or storage closet at TCU. Your professional society may recommend keeping the materials for a longer period of time.

Protections of confidentiality are taken quite seriously and include obtaining informed consent, conducting interviews in mutually agreed upon locations with each research participant, keeping data and consent forms secure, maintaining confidentiality in papers and presentations, and ensuring maintenance of confidentiality by graduate students working on the project. A master list of respondent names and corresponding codes will be created and stored along with verbal consent in a secure digital file. The master list of participant identities and their corresponding codes will be destroyed after the research reports and papers are written and respondents have had an opportunity to review and propose changes to these documents. All remaining artifacts of the study will contain no identifying information on respondents or their educational institutions.

19. <u>Potential Benefits:</u> Describe the potential benefits of the research to the participants, to others with similar problems, and to society.

Critical researchers attempt to deconstruct how social institutions create structure in a society or community. One possible benefit of critical ethnography is catalytic validity. Denzin & Lincoln (2000) argue that critical ethnography can move "those it studies to understand the world and the way in is shaped in order for them to transform it" (p. 297). Students may benefit from what they learn in youth group settings and apply to their immediate community. This benefit may be in educational attainment, health or quality of life. Students are also eligible to earn social service hours for their participation in the after school program that they need to graduate from high school in the Colombian school system.

Denzin, N. K., & Lincoln, Y.S. (2000). *Handbook of qualitative research* (2nd ed.). Los Angeles, Sage Publications, Inc.

20. <u>Training for Protecting Human Research Participants:</u> Submit training certificates for all the study investigators. The training link is available on the TCU IRB webpage at www.research.tcu.edu.

APPENDIX B

Texas Christian University

Fort Worth, Texas

PARENT'S PERMISSION FOR CHILD TO PARTICIPATE IN RESEARCH
PERMISO DE LOS PADRES A PARTICIPAR EN LA INVESTIGACION

Title of Research: Mediating Equity in Shared Water Between Community and Industry: The effects of an after school program that addresses adolescents' knowledge, attitudes, and perceptions of water science and environmental issues.

Título de la Investigación: La mediación de la equidad en el agua compartida entre la comunidad y la industria: Los efectos de un programa de actividades extracurriculares en los conocimentos, actitudes y percepciones de los adolescentes sobre la ciencia del agua y el medio ambiente.

Funding Agency/Sponsor: Punto de Encuentro[Spanish], Colombia

Agencia Financiadora / Patrocinador: Punto de Encuentro, Colombia

Study Investigators: Molly Weinburgh & Chandler Patton

Investigadores del Estudio: Molly Weinburgh & Chandler Patton

What is the purpose of the research?

The purpose of this study is to provide an understanding of young adults' knowledge, attitudes, and perceptions of water science and environmental issues and how these change during an after school program focused on shared water between the community and industry.

¿Cuál es el próposito de la investigacion?

El propósito de este estudio es el de proveer un entendimiento acerca de el conocimiento, actitudes y percepciones de los adultos respecto a la ciencia del agua y asuntos ambientales y de cómo éstos cambian durante un programa de actividades extracurriculares enfocado en el agua compartida entre la comunidad y la industria.

How many children will take part in this study?

5-8 students, ages 16-18

¿Cuántas personas participarán en este estudio?

Entre cinco y ocho estudiantes de edades que oscilan entre los dieciséis y dieciocho años

What is my and my child's involvement for taking part in this study?

Your child will participate in normal after school program activities. If you agree to your child's participation in the research, you only agree that your child's work (ex: drawings, photos, journals, videos and posters) may be used as part of the data collected for the study and that your child will be interviewed two times for thirty minutes at the school after group meetings or on the weekend. Interviews will be audio-recorded.

¿Cuál es el rol de mi hijo/a al participar en este estudio?

Usted participará en programas de actividades extracurriculares. Si usted acepta participar en esta investigación, usted solo acepta que su trabajo (ej.: dibujos, fotos, revistas, videos y carteleras) podrá ser utilizado como parte de los datos recogidos para el estudio y que será entrevistado en dos ocasiones por un espacio de treinta minutos en el colegio después de reuniones de grupo o en el fin de semana. Las entrevistas serán audio-grabadas.

For how long is my child expected to be in this study, and how much of my child's time is required?

Your child will be expected to participate normally in after school activities. The only additional time requirements will be one hour of interviews (two thirty minute sessions) that will take place after group meetings or during the day on the weekend.

¿Durante cuánto tiempo se requiere que mi hijo/a haga parte de este estudio y qué cantidad de su tiempo se requiere para el mismo?

Se espera que su hijo/a participe normalmente en actividades extracurriculares. El único tiempo adicional que se requieres son entrevistas de una hora (dos sesiones de treinta minutos) que se realizaran después de reuniones grupales o durante un el día en el fin de semana.

What are the risks of taking part in this study and how will they be minimized?

Minimum risk has been identified for your child's participation in this study. Risk to your child may include concern over having work examined by the researchers or being teased by peers for choosing to participate. The physical and psycologic risks associated with this project are similar to those found in any after school program.

¿Cuáles son los riesgos al participar en este estudio y cómo se minimizarán?

Se ha identificado que el riesgo es mínimo al hacer accesible la información para este estudio. Esto puede incluir la preocupación de ser evaluado por los investigadores o ser objeto de burla de compañeros al decidir participar en el estudio. Los riesgos físicos y psicológicos asociados con este proyecto son similares a aquellos encontrados en cualquier programa de actividades extracurriculares.

What are the benefits for taking part in the study?

Students earn social service hours for their participation in the after school program that they need to graduate from high school in the Colombian school system.

¿Cuáles son los beneficios por participar en esta investigación?

Los estudiantes ganan horas de servicios sociales para su participación en el programa de actividades extracurriculares que necesitan para graduarse de la escuela secundaria en el sistema educativo colombiano.

Will I be compensated for taking part in the study?

No

¿Estaré compensado por mi participación en este estudio?

No

What is an alternate procedure(s) that I can choose instead of having my child take part in this study?

There is no alternate procedure.

¿Qué procedimiento alterno puedo elegir en vez de participar en este estudio?

No existe procedimiento alterno.

How will my child's confidentiality be protected?

Your child's name will not be used in the final research product nor will your child's identity be inferred or eluded to in the final research product. All data will be kept in locked files. Interview recordings will be filed electronically in the TCU network with protections for limited access.

¿Cómo será protegida mi confidencialidad?

Su nombre no será utilizado en el resultado final de la investigación ni su identidad será inferida o eludida en el resultado final de la investigación. Toda la información será guardada en archivos bloqueados. Las entrevistas serán archivadas electrónicamente en la red de la universidad TCU con protección para tener acceso limitado.

Is my child's participation voluntary?

Participation in this research is completely voluntary.

¿Es voluntaria su participación?

La participación en esta investigación es totalmente voluntaria.

Can my child stop taking part in this research?

Yes. If you or your child elect not to participate or to withdraw from the research, data provided by your child up to the point of withdrawal will remain the property of the researchers.

¿Puedo detener mi participación en esta investigación?

Si. Si eligan no participar o salirse de la investigación, la información hasta ese momento seguirá siendo propiedad de los investigadores.

What are the procedures for withdrawal?

You can choose to remove your child from the research project at anytime without threat of loss of educational opportunity, coercion or other negative consequences. To withdraw, you may contact me during youth group hours, by calling my cell phone (3016363150) or e-mailing me at chandlerpatton@gmail.com.

¿Cuál es el procedimiento para retirarse?

Usted puede tomar la decisión de retirarse del proyecto de investigación en cualquier momento sin la amenaza de perder una oportunidad educativa, coerción u otras consecuencias negativas. Para retirarse, puede contactar a mí durante mis horas de grupo para jóvenes, llamándome a mi celular (3013633150) o enviándome un correo electrónico a chandlerpatton@gmail.com

Will I be given a copy of the permission document to keep?

Yes. All documentation will be presented to you verbally and written. Consent will be recorded verbally.

¿Me darán una copia del documento de consentimiento?

Si. Toda la documentacion se les sera presentada verbalmente y por escrito. El consentimiento será grabado verbalmente.

Who should I contact if I have questions regarding the study?

Chandler Patton, TCU Master's Student, Colombian Cell Phone-3016363150

¿A quien debo contactar si tengo preguntas respecto al estudio?

Chandler Patton, Estudiante de Maestría en la univiersidad TCU, Numero de celular colombiano-3016363150

Who should I contact if I have concerns regarding my child's rights as a study participant?

Dr. Morrison Wong, Chair, TCU Institutional Review Board, Telephone +001 (817) 257-7472.

Dr. Janis Morey, Director, Sponsored Research, Telephone +001 (817) 257-7516.

¿A quien debo contactar si tengo alguna inquietud o duda respecto a mis derechos como participante en el estudio?

Dr. Morrison Wong, Chair, TCU Institutional Review Board, Telefono +001 (817) -257-7472.

Dr. Janis Morey, Director, Sponsored Research, Telefono +001 (817) -257-7516.

Your recorded verbal consent indicates that you have been read the information provided above, you have received answers to all of your questions and have been told who to call if you have any more questions, you have freely allowed your child to participate in this research, and you understand that you are not giving up any of your legal rights.

Su consentimiento verbal grabado indica que ha leído o ha escuchado la información anterior, ha recibido las respuestas de todas sus dudas, ha dicho a quien contactar en caso de tener más preguntas, ha decidido libremente participar en esta investigación y entiende que no está cediendo sus derechos legales.

Please state your child's name and date of birth.

Por favor, indique el nombre de su hijo/a y la fecha de nacimiento.

Please state your name and relationship to the child.

Por favor, indique su nombre y su relación con el niño.

VITA

Personal Background

Mary Chandler Patton

Fort Worth, Texas

Daughter of Michael and Mary Martin Patton

Education

Diploma, Southwest High School, Fort Worth, Texas, 2003

Mayan Research Program, Yaxunah, Yucatan, Mexico, 2004

Bachelor of Arts, Smith College, Northampton, Massachusetts, 2007

Study Abroad, Universidad de Buenos Aires, Buenos Aires, Argentina, 2005

Master of Education, Science Education, Fort Worth, Texas, 2011

Experience

AP Physics Teacher, Colegio Karl C. Parrish, Barranquilla, Atlantico, Colombia, 2009-2011

After School Program Coordinator, Punto de Encuentr0, Malambo, Atlantico, Colombia, 2010-2011

Physics and Biology Teacher, Veterans' Memorial 9th Grade Academy, San Benito, Texas, 2007 -2009

Alumna Panelist, Smith College Panel on Community Engagement and a Fulfilling Life, Chicago, Illinois, 2008

Research Assistant, Smith College, Northampton,

Massachusetts, 2006

Public Relations Intern, Pioneer Valley Habitat for Humanity, Northampton, Massachusetts, 2006

Heath Education Programmer, Girls Inc., Holyoke, Massachusetts, 2004

Phlebotomist, Cooley Dickenson Hospital, Northampton, Massachusetts, 2003-2007

President, Five College Coordinator, Smith College Habitat for Humanity 2004-2007

Accolades

Institute on Women and Gender Travel Award- Full Funding for Research Project (March 2011)

American Institute of Aeronautics and Astronautics: Classroom Grant (February 2008)

ABSTRACT

MEDIATING EQUITY IN SHARED WATER BETWEEN COMMUNITY AND INDUSTRY: THE EFFECTS OF AN AFTER SCHOOL PROGRAM THAT ADDRESSES ADOLESCENTS' KNOWLEDGE, ATTITUDES, AND PERCEPTIONS OF WATER SCIENCE AND ENVIRONMENTAL ISSUES

By Mary Chandler Patton, M.Ed. 2011

College of Education

Texas Christian University

Thesis Advisor: Molly Weinburgh, Professor of Education

M. Francyne Huckaby, Professor of Education

Becky Johnson, Professor of Professional Practice in the School of Geology, Energy, and the Environment

This critical ethnography deconstructs how one participant researcher came to understand young adults' changing knowledge about water science and environmental issues in an after school program in Colombia. The program intended to empower self-identified young community leaders by teaching participants to engage community members in discourse related to how environmental factors impact one's level of health and quality of life. The data presented in this study illustrate how student participants responded to long-term teacher engagement and to particular curricular components that included hands-on science teaching and social justice coaching. I assessed how student interest in and knowledge of local water ecology and sanitation infrastructure changed throughout the program. Students' responses to the use of technology and digital media were also included in the analysis. The data demonstrates a dramatic change in student's attitudes and perceptions related to their environment and how they feel about their ability to make positive changes in their community.